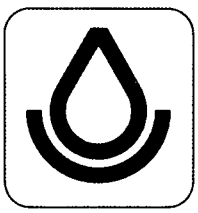
SOIL SURVEY OF

Guadalupe County, Texas



United States Department of Agriculture
Soil Conservation Service

In cooperation with
Texas Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1965–72. Soil names and descriptions were approved in 1973. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1973. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Comal-Hays-Guadalupe Soil and Water Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Guadalupe County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside

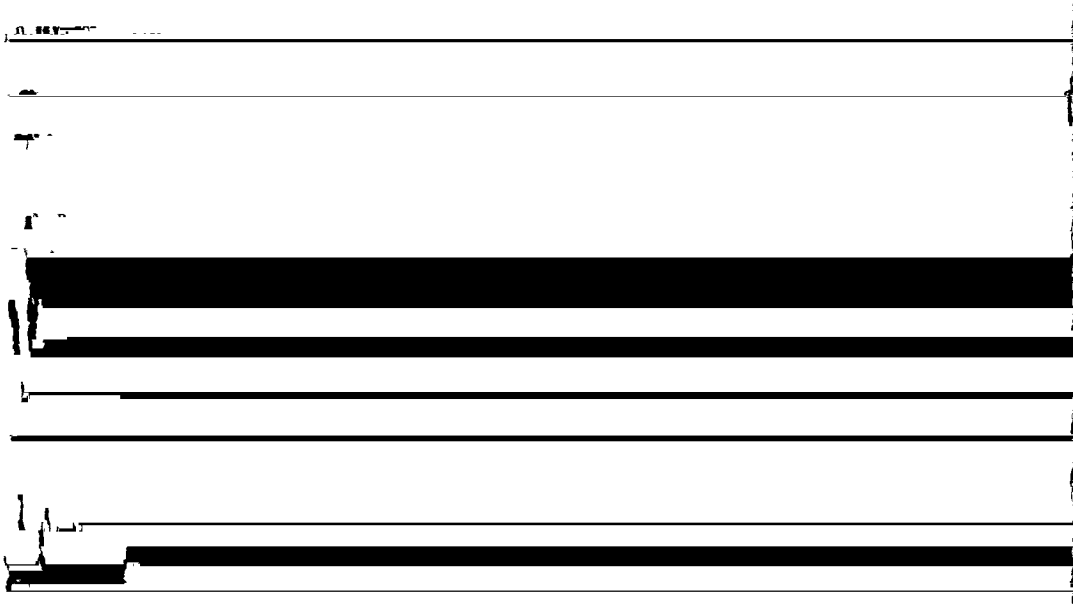
suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and the range sites.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife Habitat."

Ranchers and others can find, under "Use of the Soils for Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the



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SOIL SURVEY OF GUADALUPE COUNTY, TEXAS

BY ROBERT N. RAMSEY AND NORMAN P. BADE, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE,
IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

GUADALUPE COUNTY is in south-central Texas [redacted] There is a trend toward the conversion of cropland

phases. The name of a soil phase indicates a feature that affects management. For example, Houston Black [redacted] knowledge of soil properties, together with available research data, to predict limitations or suitability of [redacted]

[redacted]

the Houston Black series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these

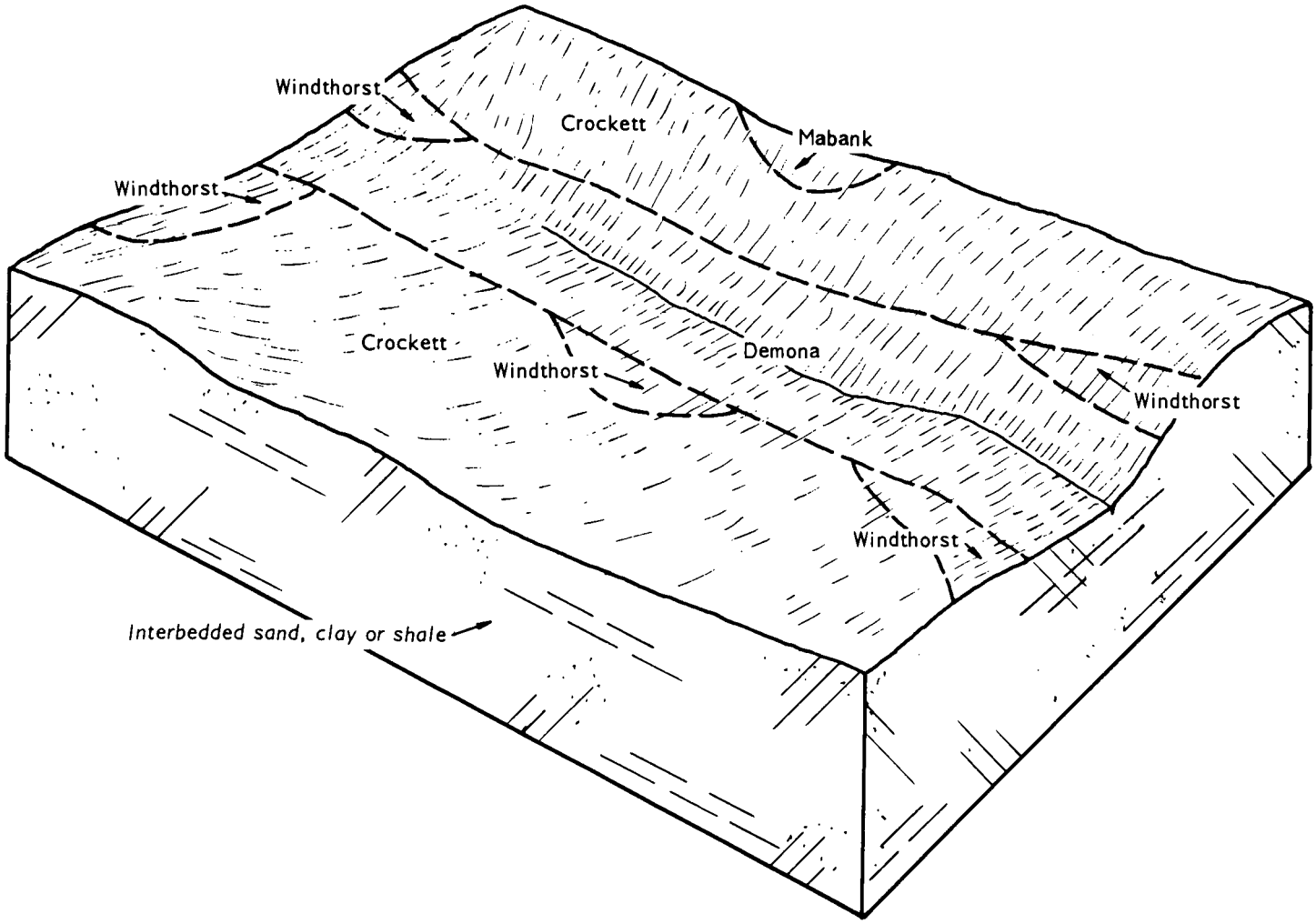


Figure 2.—**Typical pattern of soils and underlying material in association 1.**

sand about 24 inches thick. It is pale brown in the upper part and very pale brown in the lower part. The next layer, more than 36 inches thick, is mottled clay in the upper part and mottled sandy clay in the lower part.

Windthorst soils have a surface layer of yellowish-brown fine sandy loam about 8 inches thick. The next layer, to a depth of 72 inches, is mottled clay in the upper part and mottled sandy clay loam in the lower part.

This association is mainly abandoned fields, but [illegible] that are dissected in places by small creeks and drainageways (fig. 3).

This association makes up about 23 percent of the county. It is about 52 percent Branyon soils, 18 percent Barbarosa soils, 13 percent Lewisville soils, and 17 percent Trinity, Queeny, and Burleson soils.

Branyon soils are mainly in large, smooth areas. Barbarosa and Lewisville soils are on broad, low ridges. Small spots of Burleson soils are also in the large, smooth areas, small spots of Queeny soils are on ridges,

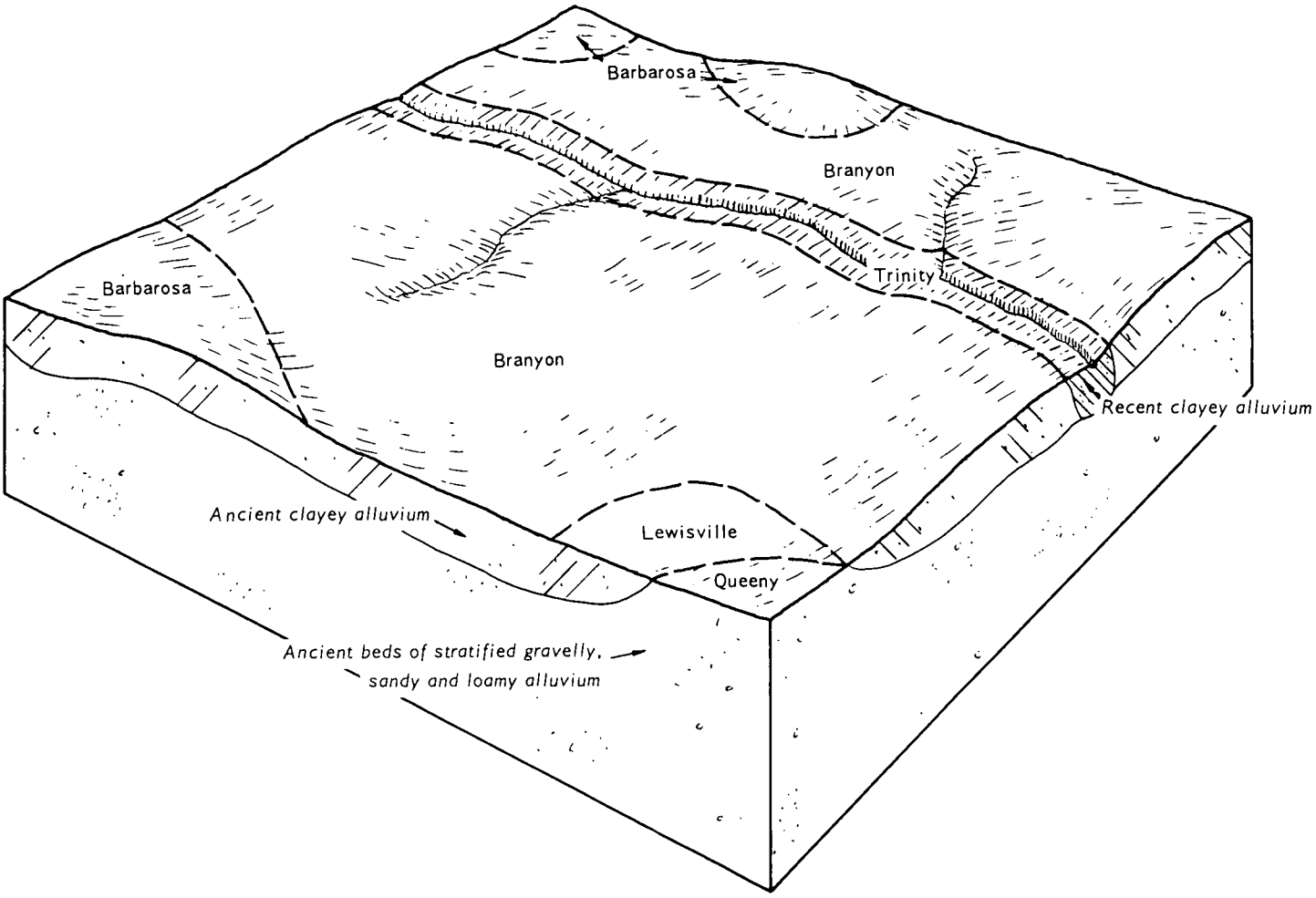


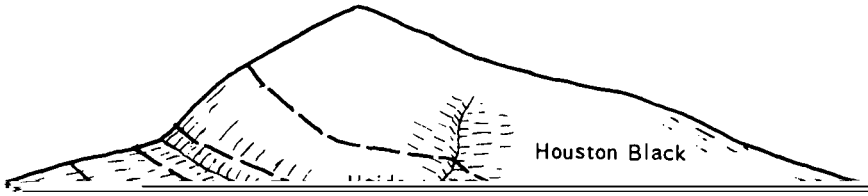
***Figure 3.*—Typical pattern of soils and underlying material in association 2.**

and light yellowish-brown silty clay loam in the lower part.

This association is used mainly for crops and is well suited to this use. It is suitable for irrigation. The soils in this association have moderate to severe limitations for septic-tank absorption fields. The shrink-

dark gray clay about 36 inches thick. The next layer, to a depth of about 60 inches, is olive-gray clay in the upper part and olive clay in the lower part.

Heiden soils have a surface layer of dark grayish-brown clay about 25 inches thick. The next layer, about 39 inches thick, is olive clay.


Houston Black

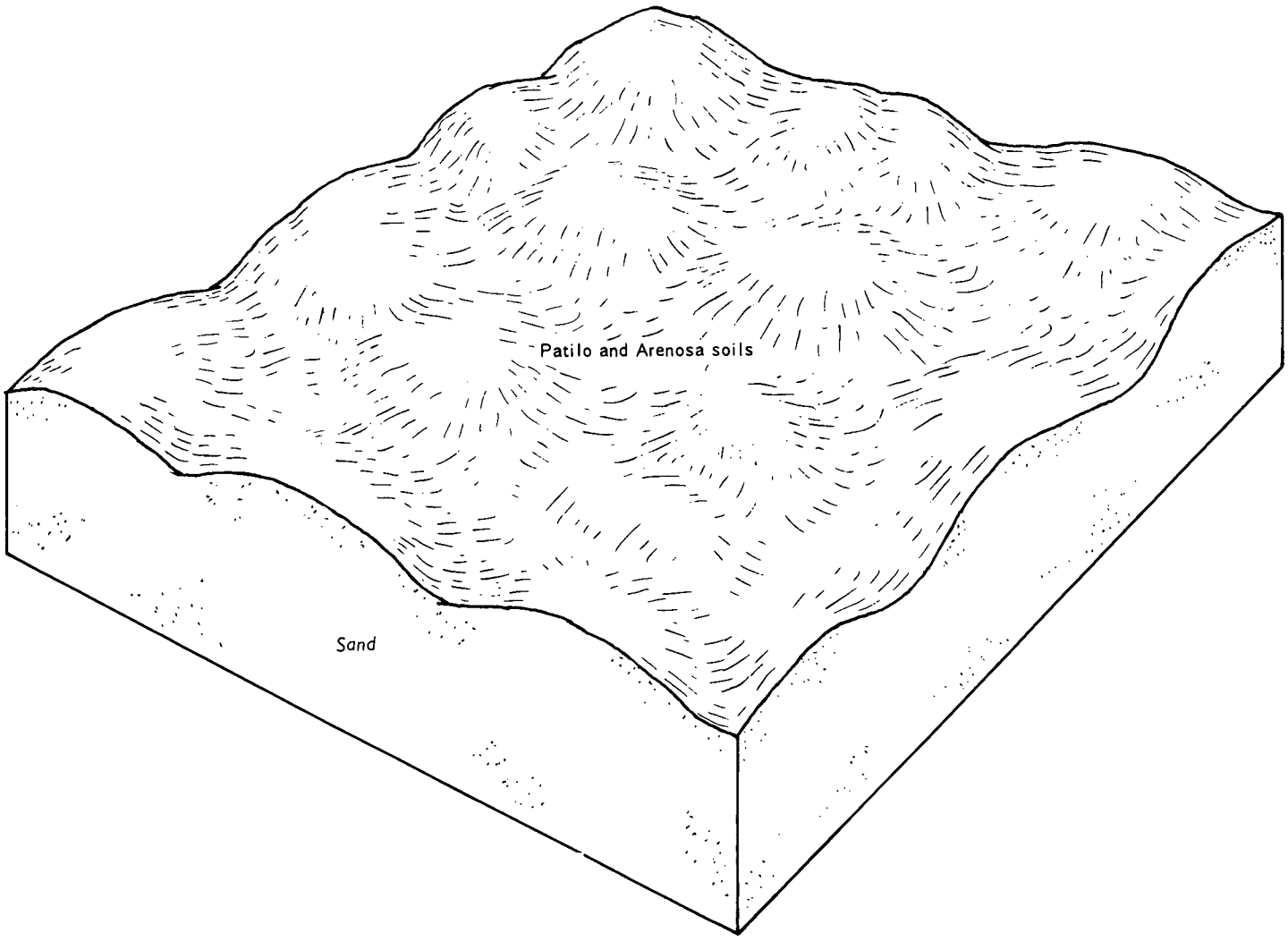


Figure 5.—**Typical pattern of soils and underlying material in association 4.**

This association makes up about 2 percent of the county. It is about 40 percent Austin soils, 19 percent Eddy soils, and 41 percent Doss, Altoga and Houston Black soils.

Austin soils are mainly on gently sloping tops of ridges. Eddy soils are on sloping sides of ridges. Small [illegible] of Doss and Altoga soils are on ridges and small

the association have severe limitations for septic-tank absorption fields because the depth to chalk is shallow. The shrink-swell potential is low to high.

Descriptions of the Soils

TABLE 1.—Approximate acreage and proportionate extent of the soils

Soil	Acres	Percent	Soil	Acres	Percent
Altoga silty clay, 3 to 5 percent slopes, eroded	1,460	0.3	Heiden clay, 5 to 8 percent slopes, eroded	3,660	0.8
			Houston Black clay, 0 to 1 percent slopes	1,040	.2

B2ca—7 to 20 inches, light yellowish-brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) moist; strong, very fine, subangular blocky structure; hard, firm; few fine roots; common wormcasts; about 5 percent, by volume, soft masses of calcium carbonate; calcium carbonate equivalent of 63 percent; calcareous, moderately alkaline; gradual, smooth boundary.

B3ca—20 to 35 inches, very pale brown (10YR 7/4) silty clay, light yellowish brown (10YR 6/4) moist; common, fine, distinct, yellowish-brown mottles; moderate, very fine, subangular blocky structure; hard, firm; about 5 to 10 percent, by volume, soft

Figure 7.—**Landscape of Arenosa fine sand, 1 to 8 percent slopes. The soil is droughty, and vegetation is thin in many areas.**

A1—0 to 8 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose; few fine roots; slightly acid; gradual, smooth boundary.

C1—8 to 84 inches, very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose; few fine roots in upper part; few yellowish-brown coatings on sand grains in lower part; medium acid; diffuse, smooth boundary.

C2—84 to 96 inches, very pale brown (10YR 8/3) fine sand, very pale brown (10YR 7/3) moist; single grained; loose; few yellowish-brown coatings on sand grains; medium acid.

The combined sandy A and C horizons are more than 80 inches thick. The A horizon ranges from 4 to 8 inches in thickness. It is pale brown, very pale brown, or light yellowish brown. The C horizon ranges from medium to slightly acid.

ArD—Arenosa fine sand, 1 to 8 percent slopes. This gently sloping to sloping soil is on uplands in areas

Austin Series

The Austin series consists of moderately deep, calcareous, gently sloping, clayey soils on uplands. These soils formed in residuum weathered from chalk and marl.

In a representative profile the surface layer is dark grayish-brown, firm silty clay about 18 inches thick. The next layer, about 10 inches thick, is brown, firm silty clay that contains a few soft masses of lime. The next lower layer, about 14 inches thick, is very pale brown silty clay loam. The underlying material, to a depth of 45 inches, is white platy chalk.

Austin soils are well drained. Runoff is slow to medium, internal drainage is medium, and permeability is moderately slow. Available water capacity is high. The hazard of water erosion is moderate.

Representative profile of Austin silty clay, 1 to 3 percent slopes, 16 miles west of Seguin on Farm Road 78 to Cibolo, 7 miles north on Farm Road 1103, 3.5 miles west on Interstate Highway 35, then 600 feet into field south of road:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate, fine and medium, granular structure; hard, firm; few chalk fragments on surface; calcium carbonate equivalent of 42 percent; calcareous, moderately alkaline; clear, smooth boundary.

A1—6 to 18 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate, medium, granular, and very fine subangular blocky structure; hard, firm; calcium carbonate equivalent of 42 percent; calcareous, moderately alkaline; clear, smooth boundary.

B2—18 to 28 inches, brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; strong, fine, subangular blocky structure; hard, firm; common wormcasts; few soft masses of calcium carbonate; calcium carbonate equivalent of 54 percent; calcareous, moderately alkaline; clear lower boundary.

C1ca—28 to 42 inches, very pale brown (10YR 7/3) silty clay loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable; about 8 percent, by volume, soft masses of calcium carbonate; calcium carbonate equivalent of 76 percent; calcareous, moderately alkaline; clear, smooth boundary.

C2—42 to 45 inches, white platy chalk and very pale brown silty clay loam from C1ca horizon in a few fine crevices; chalk hardness less than 3 on Mohs scale.

The solum ranges from 20 to 32 inches thickness. Clay content between depths of 10 and 32 inches ranges from 35 to 50 percent. Content of silicate clay ranges from 25 to 35

as Austin soils and a few spots of Doss soils on ridgetops. These spots are less than 5 acres in size.

Runoff is medium. The hazard of water erosion is

eroded cropland. A few areas are used for growing grazing crops. The soil is suited to improved pasture grasses if gullies are shaped, smoothed, and filled. Suburban development has expanded to some areas. Capability unit IVe–1; Clay Loam range site.

Barbarosa Series

The Barbarosa series consists of deep, noncalcareous, nearly level to gently sloping, clayey soils on an-

calcareous, clayey alluvium.

In a representative profile the surface layer is very dark grayish-brown silty clay about 24 inches thick. The next layer, to a depth of 72 inches, is clay. It is reddish brown in the upper part and reddish yellow in the lower part.

Barbarosa soils are well drained. Runoff is slow to

This nearly level soil is on terraces. Areas are mainly 100 to 200 acres in size, but they range from 10 to 400

fine pores; few wormcasts; few films and threads of calcium carbonate; few thin clayey strata; calcareous, moderately alkaline; gradual, smooth bound-

Branyon soils are moderately well drained. Runoff is slow to medium, internal drainage is slow, and permeability is very slow. When the soils are dry, water enters cracks rapidly until they close. Available water capacity is high. The hazard of water erosion is slight to moderate.

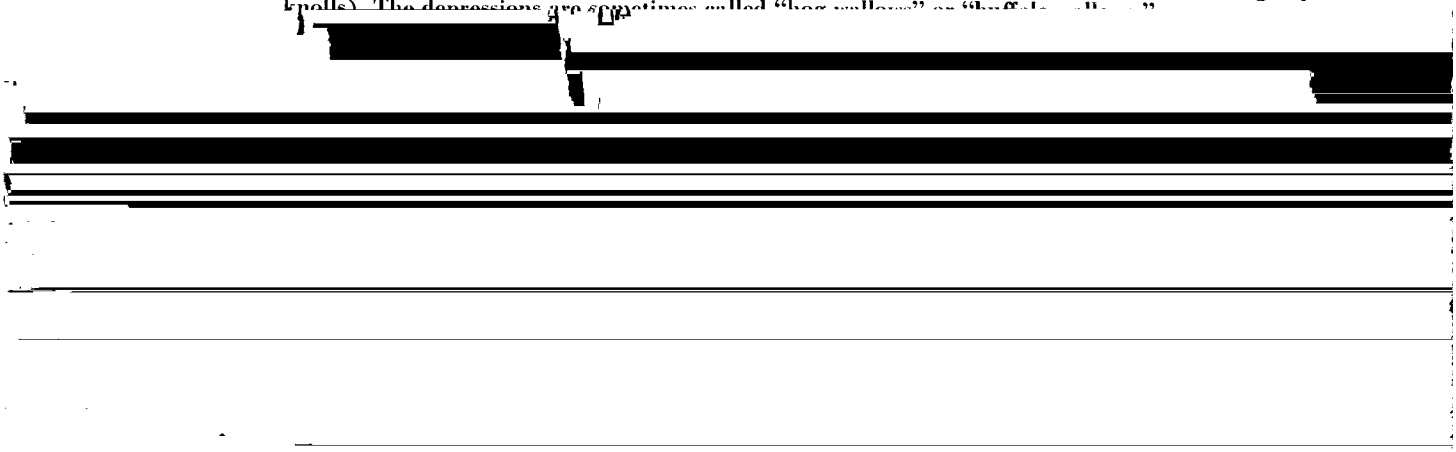
Representative profile of Branyon clay, 0 to 1 percent slopes, at the center of a microdepression 6 miles north of Seguin on Texas Highway 123 to Geronimo, 2.5 miles west on paved road to Friedens Church,

concretions, soft masses of calcium carbonate, and a few, fine, black or brown, iron-manganese concretions.

The IICca horizon is silty clay loam, loam, or clay loam. It is 5 to 10 percent, by volume, fine calcium-carbonate concretions and medium soft lumps of calcium carbonate. In some profiles limestone pebbles make up 50 percent, by volume, of the soil material, and the material is stratified with sand below a depth of about 10 feet.

BrA—Branyon clay, 0 to 1 percent slopes. This nearly level soil is mainly on old, high terraces. Many of the soil areas are as much as 1,000 acres or more in size.

Figure 9.—Native pasture in an area of Branyon clay, 0 to 1 percent slopes, showing gilgai microrelief (alternating depressions and knolls). The depressions are sometimes called "hog wallows" or "buffalo wallows."



is slow to medium, internal drainage is slow, and permeability is very slow. When the soils are dry, water enters cracks rapidly until they close. Available water capacity is high. The hazard of water erosion is slight to moderate.

Representative profile of Burleson gravelly clay, 1 to 3 percent slopes, in a microdepression 9 miles north of Seguin on Texas Highway 123, 8 miles northeast on Farm Road 1339, 1.5 miles northwest on gravel road, then 0.5 mile into field east of road:

parallelepipeds tilted more than 30 degrees from horizontal below a depth of 20 inches; few siliceous pebbles; few, fine, iron-manganese concretions; mildly alkaline; diffuse, wavy boundary.

AC—30 to 42 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; few, fine, faint, grayish-brown mottles; weak, medium, angular blocky structure; extremely hard, very firm, very sticky and very plastic; intersecting slickensides on parallelepipeds tilted more than 30 degrees from horizontal; streaks of very dark gray clay in old cracks; few siliceous pebbles; few iron-manganese concretions; mildly

calcium-carbonate concretions, iron-manganese concretions, and siliceous pebbles are in places. The AC horizon is mildly or moderately alkaline.

The C horizon ranges from gray to light olive gray. Mottles in shades of olive, brown, and yellow are present in places. Calcium-carbonate concretions, iron-manganese concretions, and limestone pebbles are present in many places.

BuA—Burleson clay, 0 to 1 percent slopes. This nearly level soil is on low, ancient stream terraces. Areas are oval and range from about 10 to 50 acres in size.

The surface layer is very dark gray clay, has a thin [illegible] about 20 inches thick. The

face acts as a mulch and reduces water evaporation. Capability unit IIe–1; Blackland range site.

Crockett Series

The Crockett series consists of deep, noncalcareous, nearly level to sloping, loamy soils on uplands.

In a representative profile the surface layer is brown fine sandy loam about 8 inches thick. The upper 38 inches of the subsoil is clay. It is mottled brownish yellow, light olive brown, and red in the upper 6 inches; olive yellow mottled with red and brownish

The A horizon is dark grayish-brown, grayish-brown, dark-brown, or brown fine sandy loam, loam, or gravelly sandy loam. Siliceous pebbles are as much as 50 percent, by volume, of the A horizon in places. Reaction ranges from slightly acid to neutral.

The B21t horizon ranges widely in color within short distances. In places it has a mottled matrix in any combination of red, gray, brown, olive, or yellow. In other places it has a matrix color of reddish brown or dark reddish brown and is mottled in any combination of red, gray, brown, olive, or yellow. The lower part of the B2t horizon and the B3 horizon are mainly shades of brown, gray, yellow, and olive. The B horizon ranges from clay loam to clay, and the content of clay ranges from 35 to 50 percent. The upper 20 inches of the Bt horizon contains as much as 15 percent, by volume, siliceous pebbles. Reaction in the B horizon ranges from medium acid to slightly acid in the upper part and from slightly acid to mildly alkaline in the lower part.

The C horizon is mainly interbedded sand, clay, or shale. It ranges from clay shale, clay interbedded with sand

irregular, oval shape, and larger areas have an irregular, long shape. Areas range from 10 to 150 acres in size. Slopes are single and convex and have a gradient that averages about 3 percent.

The surface layer is dark-brown gravelly sandy loam about 10 inches thick. It is about 40 to 50 percent chert pebbles. The next layer is strong-brown, very firm sandy clay about 13 inches thick. The next lower layer is light brownish-gray, very firm sandy clay about 13 inches thick. The underlying material, below a depth of 44 inches, is light-gray, very firm shaly clay interbedded with brownish-yellow sand.

Included with this soil in mapping are spots of Vernia, Mabank, and Windthorst soils. Vernia and Windthorst soils are on low ridges, and Mabank soils are in low areas. The

20 to 25 percent of the mapped areas. Gullies, 3 to 20 [redacted] ture; very hard, firm; few fine roots; few fine pores; few thin clay films on ped faces and in pores; [redacted]

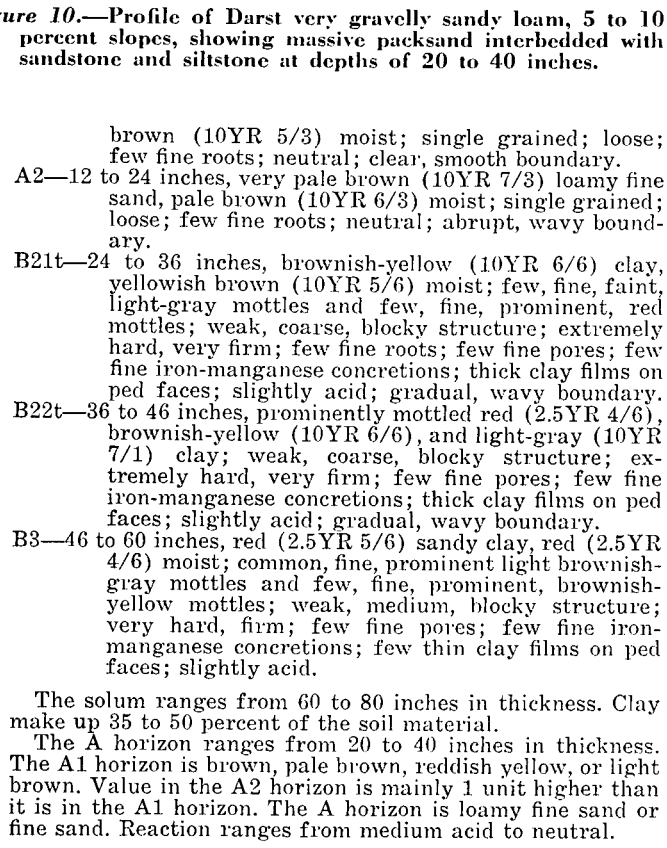


Figure 10.—**Profile of Darst very gravelly sandy loam, 5 to 10 percent slopes, showing massive packsand interbedded with sandstone and siltstone at depths of 20 to 40 inches.**

brown (10YR 5/3) moist; single grained; loose; few fine roots; neutral; clear, smooth boundary.

A2—12 to 24 inches, very pale brown (10YR 7/3) loamy fine sand, pale brown (10YR 6/3) moist; single grained; loose; few fine roots; neutral; abrupt, wavy boundary.

B21t—24 to 36 inches, brownish-yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) moist; few, fine, faint, light-gray mottles and few, fine, prominent, red mottles; weak, coarse, blocky structure; extremely hard, very firm; few fine roots; few fine pores; few fine iron-manganese concretions; thick clay films on ped faces; slightly acid; gradual, wavy boundary.

B22t—36 to 46 inches, prominently mottled red (2.5YR 4/6), brownish-yellow (10YR 6/6), and light-gray (10YR 7/1) clay; weak, coarse, blocky structure; extremely hard, very firm; few fine pores; few fine iron-manganese concretions; thick clay films on ped faces; slightly acid; gradual, wavy boundary.

B3—46 to 60 inches, red (2.5YR 5/6) sandy clay, red (2.5YR 4/6) moist; common, fine, prominent light brownish-gray mottles and few, fine, prominent, brownish-yellow mottles; weak, medium, blocky structure; very hard, firm; few fine pores; few fine iron-manganese concretions; few thin clay films on ped faces; slightly acid.

The solum ranges from 60 to 80 inches in thickness. Clay make up 35 to 50 percent of the soil material.

The A horizon ranges from 20 to 40 inches in thickness. The A1 horizon is brown, pale brown, reddish yellow, or light brown. Value in the A2 horizon is mainly 1 unit higher than it is in the A1 horizon. The A horizon is loamy fine sand or fine sand. Reaction ranges from medium acid to neutral.

The B horizon ranges from 30 to 50 inches in thickness. Matrix coloring ranges from brownish yellow or red mottled in shades of red, gray, brown, or yellow to a mottled coloring in shades of red, gray, brown, or yellow. The B2t horizon ranges from sandy clay to clay. The B3 horizon ranges from sandy clay loam to sandy clay. Reaction in the B2t horizon ranges from strongly acid to slightly acid. Reaction in the B3 horizon ranges from medium acid to mildly alkaline. The C horizon, where present, is medium acid to mildly alkaline, interbedded sand and clay in shades of red, gray, brown, or yellow.

DmC—Demona loamy fine sand, 1 to 5 percent slopes. This gently sloping soil is mainly in irregularly shaped, concave areas. Areas range from about 10 acres to as much as 300 acres in size. Slopes have a gradient that averages about 2 percent (fig. 11).

Included with this soil in mapping in most areas is a soil similar to this Demona soil, but the surface layer is only 16 to 20 inches thick. It makes up about 21 percent of the mapped areas and is in the same position as this Demona soil but does not occur in a pattern. It appears to have been formed by wind erosion that thinned the surface of Demona soils. A few spots of Patilo, Windthorst, and Crockett soils are included in some areas. Patilo and Windthorst soils are on ridges, and Crockett soils are in low areas. These spots are less than 2 acres in size.

Runoff is slow to medium. The hazards of water

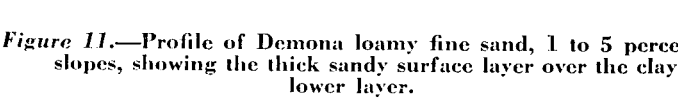


Figure 11.—**Profile of Demona loamy fine sand, 1 to 5 percent slopes, showing the thick sandy surface layer over the clayey lower layer.**

erosion and soil blowing are moderate. The soil is used mainly for improved pasture and such specialty crops as peanuts and watermelons, and it is well suited to these uses. It is suited to a sprinkler irrigation system. A few areas are in native range, and brush encroachment is a concern in these areas. Capability unit IIIe–4; Sandy range site.

Doss Series

The Doss series consists of shallow, calcareous, gently sloping, clayey soils on uplands. These soils formed in residuum weathered from calcareous marl and weakly cemented limestone.

In a representative profile the surface layer is dark grayish-brown silty clay about 8 inches thick. The next layer, about 7 inches thick, is brown, firm silty clay that is about 10 percent, by volume, platy chalk fragments. The underlying material, to a depth of 20 inches, is white platy chalk that has dark grayish-brown silty clay in a few small cracks in the upper part.

Doss soils are well drained. Runoff is medium, internal drainage is medium, and permeability is moderately slow. Available water capacity is low. The hazard of water erosion is moderate.

Austin soils are in low areas. These spots are less than 3 acres in size. They make up less than 15 percent of the mapped areas.

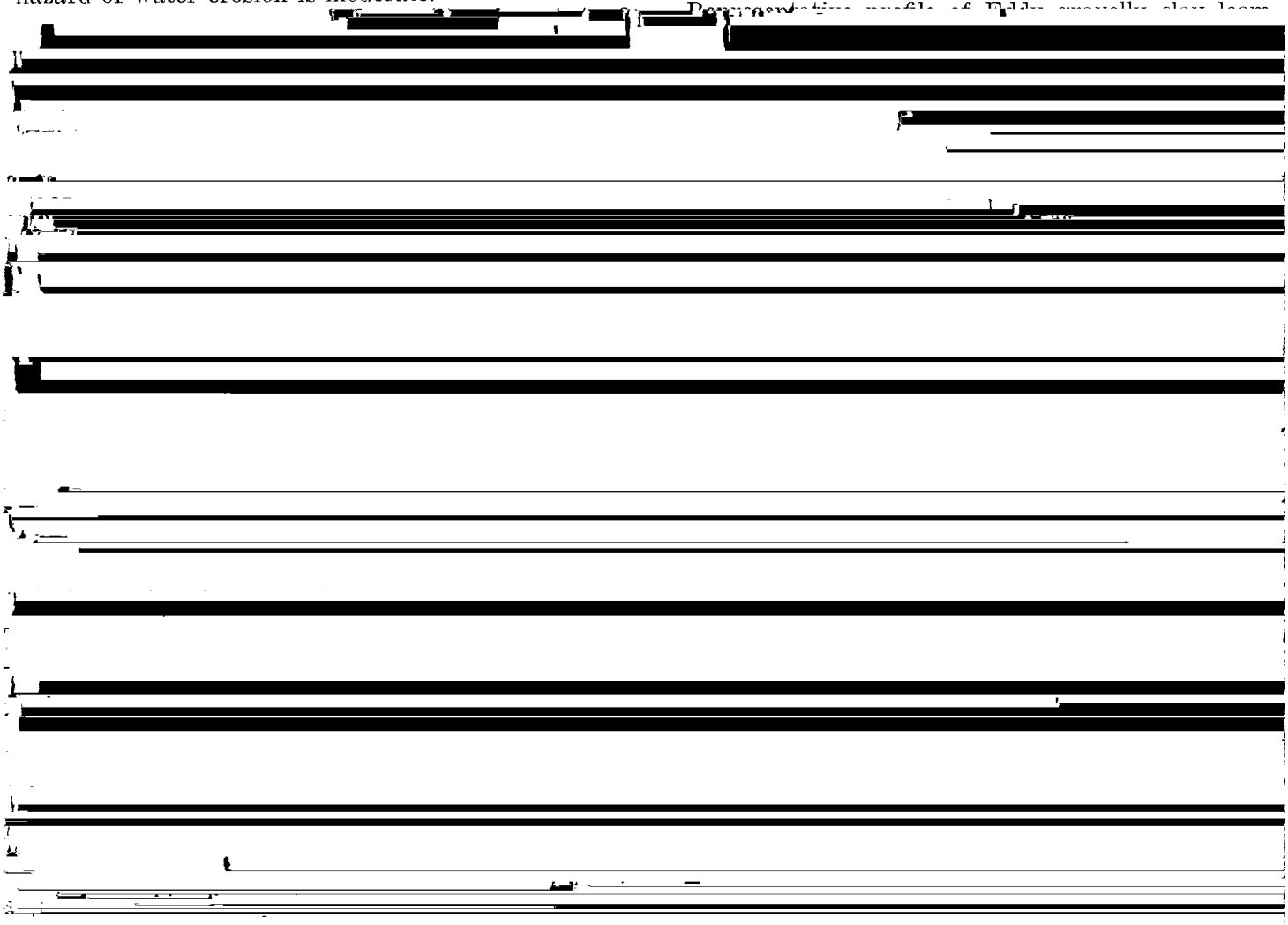
Runoff is medium. The hazard of water erosion is moderate. This soil is used mainly for native range and suburban development. A few areas are used for grazing. Because chalk is at a shallow depth, the soil is not suited to crops or improved pastures. Scattered live oak trees make this soil suited to homesites. Capability unit IIIe–5; Chalky Ridge range site.

Eddy Series

The Eddy series consists of very shallow, calcareous, gently sloping, gravelly, loamy soils on uplands. These soils formed in material weathered from chalk.

In a representative profile the surface layer is grayish brown, gravelly clay loam about 4 inches thick. It is about 50 percent, by volume, platy chalk fragments. The underlying material, to a depth of 10 inches, is white platy chalk. Clay loam from the surface layer is in a few fine cracks.

Eddy soils are well drained. Runoff is medium, and permeability is moderately slow. Available water capacity is very low. The hazard of water erosion is moderate.



calcareous, moderately alkaline; diffuse, wavy boundary.

C—36 to 60 inches, pale-olive (5Y 6/4) shaly clay, olive (5Y 5/4) moist; few, fine, prominent, olive-yellow mottles; massive; extremely hard, very firm, very sticky and very plastic; few slickensides; few fine gypsum crystals; calcareous, moderately alkaline.

The A1 and AC horizons combined range from 30 to more than 60 inches in thickness. Clay makes up 50 to 60 percent of the soil material between depths of 10 and 40 inches. The A1 horizon is 5 to 10 inches thick. It is dark [illegible]

and cracked, but permeability is very slow when the soils are wet. Available water capacity is high. The hazard of water erosion is moderate to severe.

Representative profile of Heiden clay, 3 to 5 percent slopes, eroded, 8 miles north of Seguin on Texas Highway 123, about 3 miles east on paved county road, then 100 feet into field south of road:

Ap—0 to 6 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate, fine, angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; surface mulch of fine, discrete, hard aggregates

are short and single and have a gradient that averages about 4 percent.

The surface layer is dark grayish-brown, very firm clay about 18 inches thick. The next layer is olive, very firm clay. It has dark grayish-brown streaks in old filled cracks and a few yellow mottles. This layer is about 24 inches thick. It is underlain, below a depth of 42 inches, by pale-olive, very firm shaly clay.

Included with this soil in mapping are spots of Houston Black soils. They are in about the same position as this Heiden soil. These spots are less than 3

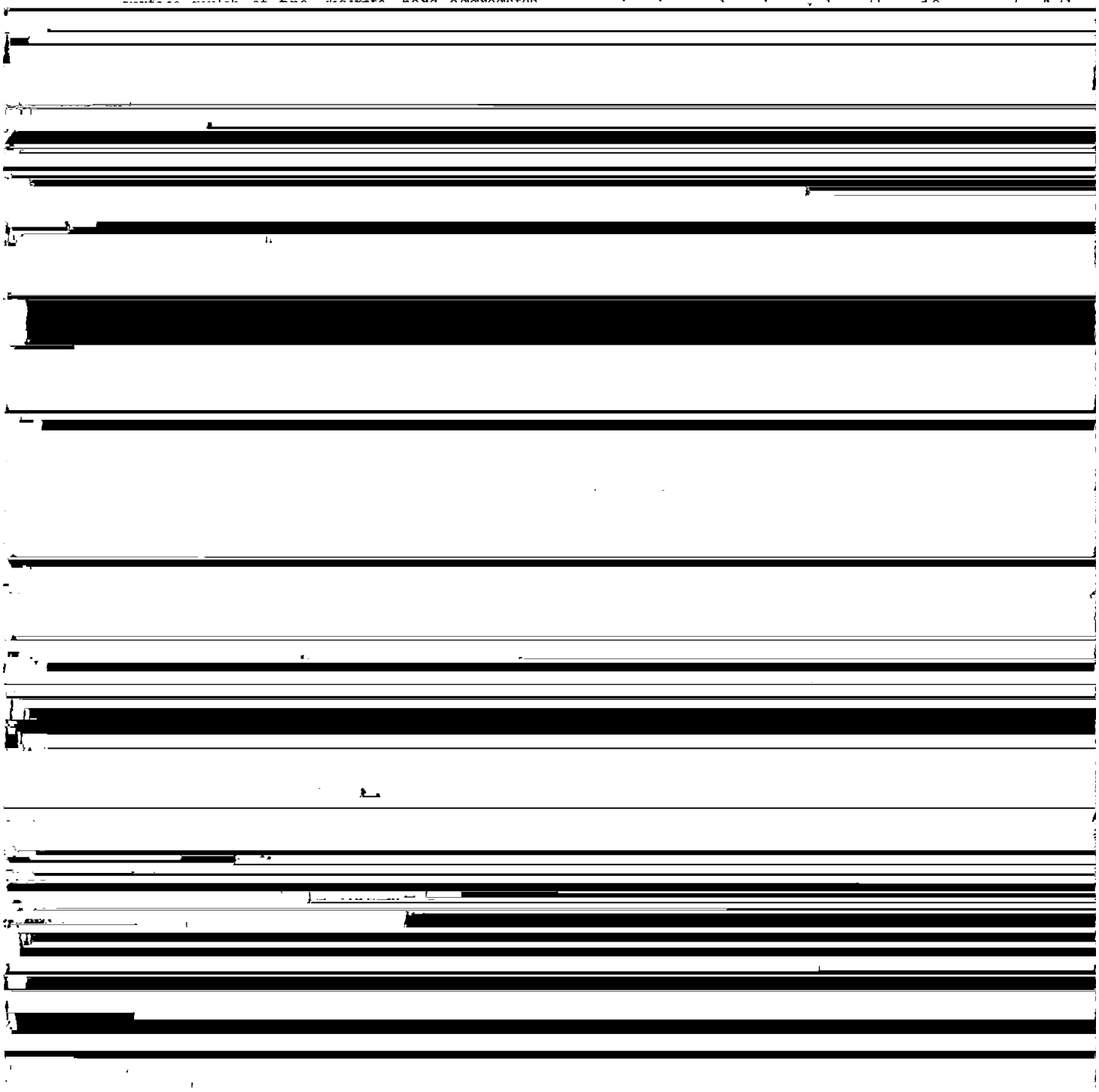


Figure 13.—**Landscape of Heiden clay, 3 to 5 percent slopes, eroded, showing the gentle slopes and the location of the drainageways.**

grazing. It is better suited to improved pasture grasses than to most other uses if gullies are shaped, smoothed, and filled. Capability unit IVe–3; Blackland range site.

Houston Black Series

The Houston Black series consists of deep, calcareous, nearly level to gently sloping, clayey soils on uplands. These soils formed in calcareous clay or marl.

In a representative profile the surface layer is very dark gray, very firm clay about 26 inches thick. The

on Farm Road 621, 0.75 mile east on gravel road, then 100 feet into field south of road:

Ap—0 to 6 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate, fine and medium, granular and subangular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; shiny ped faces; surface mulch of fine, discrete, hard, aggregates about 0.5 inch thick; few siliceous pebbles on surface; few, fine, iron-manganese concretions; calcareous, moderately alkaline; clear, smooth boundary.

A1—6 to 36 inches, very dark gray (10YR 3/1) clay, black

AC2—48 to 60 inches, olive (5Y 5/3) clay, olive (5Y 4/3) moist; few, fine, faint, yellow mottles; weak, fine, blocky structure; very hard, very firm, very sticky and very plastic; shiny ped faces; few intersecting slickensides; parallelepipeds tilted more than 10 degrees from horizontal; few, fine, calcium-carbonate and iron-manganese concretions; calcareous, moderately alkaline.

The A and AC horizons are more than 60 inches thick. Within a horizontal distance of about 8 to 10 feet, the A horizon ranges in thickness from 8 inches in the center of [redacted]

brown, very firm clay in the upper part and olive, very firm clay in the lower part. It has streaks of very dark gray clay in old cracks and has olive-yellow mottles.

Included with this soil in mapping are spots of Burleson soils that have a crusty surface and are in about the same position as Houston Black soils. These spots make up less than 10 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is [redacted]

Jedd Series

The Jedd series consists of moderately deep, noncalcareous, gently sloping to sloping, cobbly, loamy soils on uplands. These soils formed in weakly consolidated to weakly cemented sandstone.

In a representative profile the surface layer is cobbly sandy loam about 10 inches thick. It is brown in

nearly level to gently sloping, clayey soils on stream terraces. These soils formed in ancient, calcareous, clayey alluvium.

In a representative profile the surface layer is dark grayish-brown silty clay about 13 inches thick. The next layer, about 47 inches thick, is brown, firm silty clay in the upper part; yellowish-brown, firm silty clay in the middle part; and light yellowish-brown,

barosa, Sunev, Branyon, and Queeny soils. Barbarosa and Branyon soils are in low areas. Sunev soils are on low knolls and ridges above Lewisville soils. Queeny soils occur as shallow spots. These spots are less than 3 acres in size.

Runoff is slow. The hazard of water erosion is slight. The soil is used for crops. It is suited to improved pasture grasses and to irrigation if water is available. Capability unit I–1; Clay Loam range site.

LeB—Lewisville silty clay, 1 to 3 percent slopes. This gently sloping soil is on terraces in long, narrow areas that slope to small drainageways. Areas are about 10 to 50 acres in size. Slopes are single and have a gradient that averages about 2 percent.

The surface layer is dark grayish-brown silty clay

blocky structure; extremely hard, very firm; few fine roots in upper part; thin clay films on ped faces; few streaks of dark-gray loam from A1 horizon in old filled cracks; few, fine, iron-manganese concretions; few siliceous pebbles; mildly alkaline; gradual, smooth boundary.

B23tg—40 to 66 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; few, fine, faint, brownish-yellow mottles; weak, coarse, blocky structure; extremely hard, very firm; thin clay films on ped faces; few, fine, calcium-carbonate concretions; common siliceous pebbles; mildly alkaline.

The solum is more than 60 inches thick. The A horizon ranges from 4 to 12 inches in thickness. It is dark gray or dark grayish brown. It has a thin light-gray or light brownish-gray surface crust when dry. Reaction in the A horizon ranges from slightly acid to neutral.

Clay makes up 35 to 50 percent of the soil material be-

This gently sloping soil is in areas that have an irregular, oval shape and in areas that are long and narrow. Areas range from about 10 to 80 acres in size. Slopes are both single and convex and have a gradient that averages about 2 percent. The surface layer has been removed in about 25 to 40 percent of most mapped areas. Many areas contain a few gullies that are mainly 6 to 10 feet wide, 2 to 8 feet deep, and 200 to 400 feet apart. The gullies make up about 10 to 15 percent of the mapped areas.

The surface layer in most areas is dark-gray loam about 14 inches thick. The next layer, to a depth of more than 60 inches, is very firm clay. The upper part is very dark gray, and the lower part is grayish brown and has yellowish mottles. Interbedded sand and clay is below a depth of about 7 feet in most places.

Included with this soil in mapping are a few spots of Crockett, Heiden, and Windthorst soils that are in about the same position as Mabank soils. The spots make up less than 15 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is moderate. The soil is mainly in abandoned, eroded cropland. Brush infestation is a concern. A few areas are used for grazing crops. The soil is better suited to improved pasture grasses than to most other uses if gullies are shaped, smoothed, and filled and brush is controlled. Capability unit IVe–2; Claypan Prairie range site.

Nebgen Series

The Nebgen series consists of very shallow to shallow, noncalcareous, gently sloping to moderately steep, cobbly, loamy soils on uplands. These soils formed in noncalcareous, loamy material weathered from sandstone.

In a representative profile the surface layer is reddish-brown, cobbly sandy loam about 7 inches thick. It is about 25 percent, by volume, 1- to 10-inch angular sandstone fragments. About 20 [illegible] of the

sandy loam. It is 15 to 25 percent, by volume, sandstones and cobbles.

The C horizon is reddish or brownish acid sandstone that is strongly cemented when dry and weakly cemented when moist.

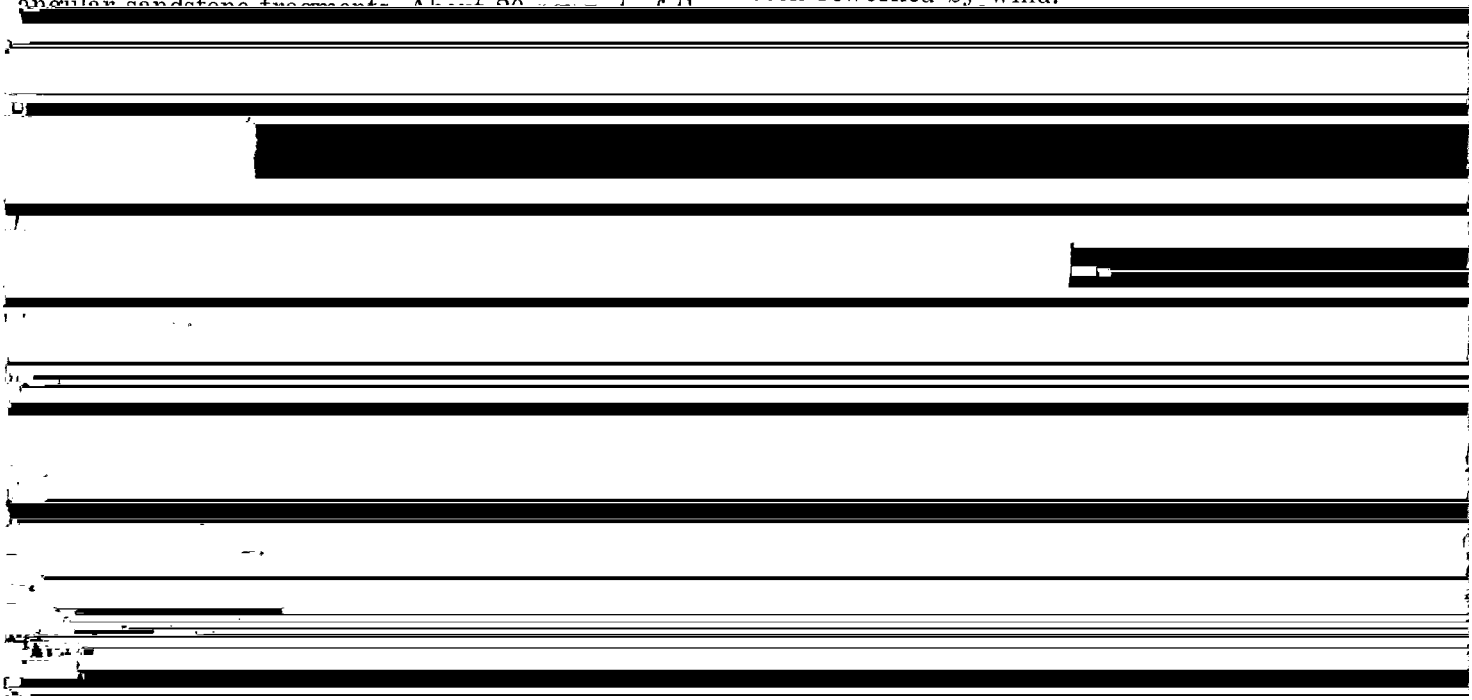
NcF—Nebgen-Jedd complex, 3 to 20 percent slopes. These gently sloping to moderately steep soils are on small knolls and ridges. The knolls are oval and range from about 6 to 40 acres in size. The ridges are long and narrow and range from 50 to 175 acres in size. Slopes are convex and have a gradient that ranges from 3 to 30 percent. In places as much as 60 to 75 percent of the surface is covered with sandstones and boulders that are mainly 2 to 8 feet in diameter.

The areas of Nebgen and Jedd soils are so intricately mixed and so small in size that they cannot be shown separately on the soil map. Mapped areas are about 53 percent Nebgen cobbly sandy loam and 40 percent Jedd cobbly sandy loam. The other 7 percent is a soil similar to this Jedd soil that has sandstone at a depth of 10 to 20 inches. In most mapped areas the Nebgen soil is on sides of knolls and ridges where slopes are about 8 to 20 percent. The Jedd soil is mainly on tops of knolls and ridges where slopes range from 3 to 8 percent. In some mapped areas Nebgen and Jedd soils are on tops and sides of knolls and ridges. Included in mapping are a few areas on the sides of ridges where short slopes are as much as 60 percent.

Runoff is rapid. The hazard of water erosion is moderate. The soils are in native range. They are not suited to crops or improved pasture because of stoniness and slope (fig. 15). Capability unit VIIs–1; Sandstone Hills range site.

Patilo Series

The Patilo series consists of deep, noncalcareous, gently sloping to sloping, sandy soils on uplands. These soils formed in thick sandy beds that appear to have been reworked by wind.

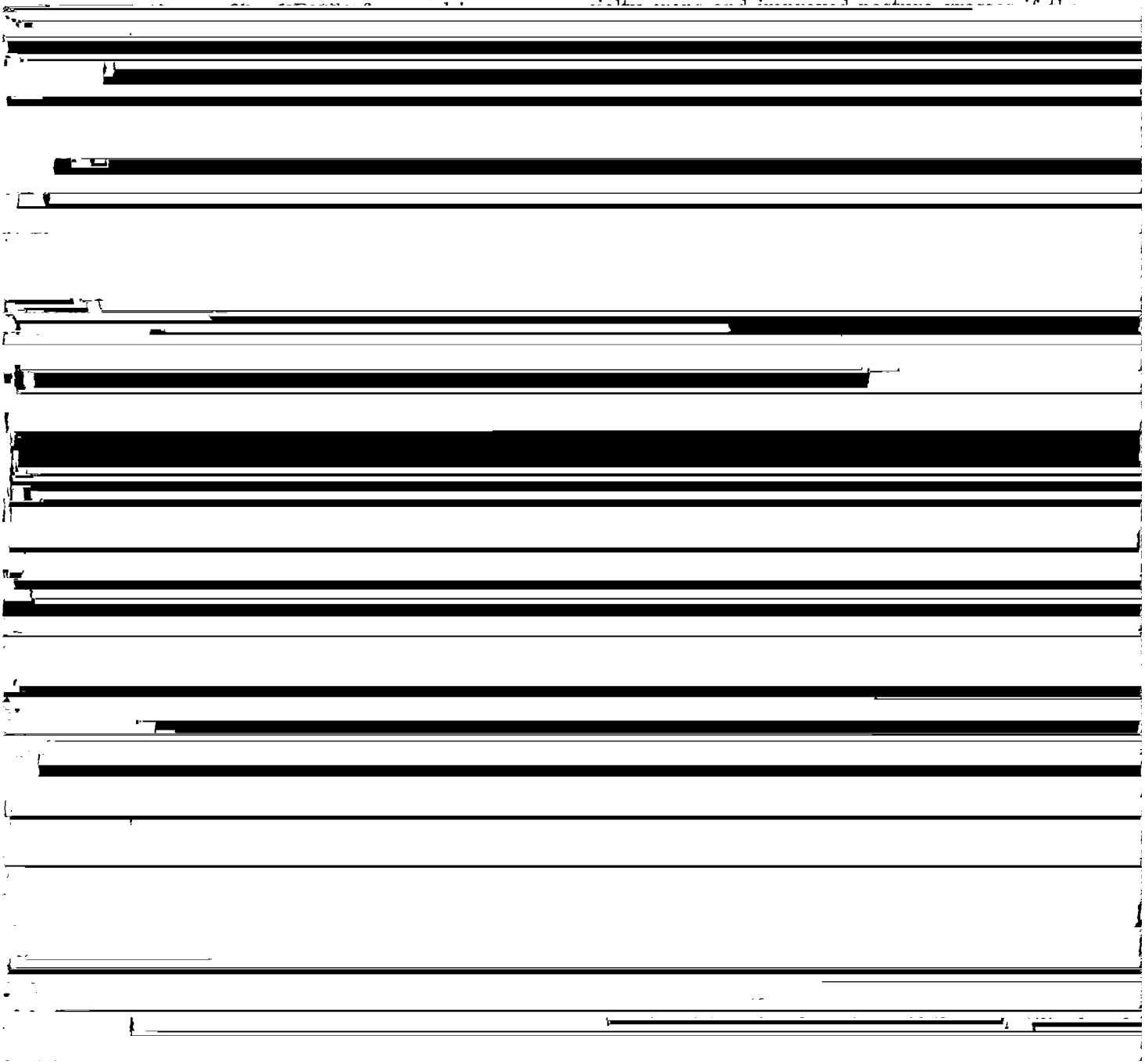


In a representative profile the surface layer is loose, fine sand about 52 inches thick. It is light brownish gray in the upper part and very pale brown in the lower part. The next layer, to a depth of 84 inches, is mottled brownish-yellow, light brownish-gray, and red, strongly acid, firm sandy clay loam in the upper part and yellowish-red, strongly acid, firm sandy clay loam in the lower part. The lower part has a few strong-brown and light brownish-gray mottles.

Patilo soils are moderately well drained. Runoff is very slow, permeability is rapid in the surface layer, and internal drainage and permeability in the lower layers are moderately slow. Available water capacity is low. The hazard of water erosion is slight.

as 80 percent. A soil similar to Patilo fine sand makes up about 22 percent of the mapped areas. It has a sandy surface layer less than 40 inches thick. The Patilo soil is in all mapped areas, but the Arenosa soil is not. Arenosa fine sand is on the middle and upper parts of hills, Patilo fine sand is on the middle and lower parts of hills, and the soil similar to Patilo fine sand is in narrow valleys and along small drainageways.

These soils have little or no runoff. The hazard of water erosion is slight. The soils are used mainly for native range and for recreation. Native trees provide food and protection for wildlife. The soils are droughty and low in natural fertility. They are suited to spe-



few soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 4 to 12 inches in thickness. The A horizon is 12 to about 25 percent, by volume, siliceous pebbles and stones and a few limestone pebbles. Calcium carbonate equivalent is 1 to 5 percent. The A horizon is grayish brown, dark grayish brown, very dark grayish brown, or dark brown.

The C1cam horizon is 2 to 18 inches thick. It has an estimated hardness of 2 to 3 on Mohs' scale and is uniformly plugged with carbonates. The C2ca horizon is 20 to 96 inches thick. It is massive caliche that is indurated or soft. The IIC horizon ranges from 50 to 80 percent, by volume, pebbles that are chert, quartz, jasper, quartzite, limestone, and silicified wood and 20 to 50 percent calcareous, brownish-yellow and light-gray fine sand. The pebbles are mainly 0.125 to 0.75 inch in diameter, but they range to as much as 3 inches in diameter. Some of the fine sand is in interbedded layers that are 0.25 inch to 4 inches thick and 2 to 6 inches apart.

QeC—Queeny gravelly loam, 1 to 5 percent slopes. This gently sloping soil is mainly on terraces. Most areas are long and narrow, but some have an irregular, oval shape. They range from about 5 to 30 acres in size. Slopes are convex and have a gradient that averages about 3 percent. This soil has the profile described as representative of the series (fig. 16). The gravel content of the surface layer is variable and ranges from practically none to about 25 percent, by volume, in small areas.

Included with this soil in mapping are spots of Quihi, Lewisville, and Sunev soils. These soils are in about the same position as Queeny soils, but they have a thicker solum overlying the gravel bed. These spots are less than 2 acres in size.

Runoff is medium. The hazard of water erosion is slight. The soil is used mainly as a source of gravel for road construction. A few areas are used for grazing crops. The soil is poorly suited to cultivated crops or improved pasture grasses because of the depth to the gravel and sand beds. Capability unit IVs–2; Chalky Ridge range site.

QeF—Queeny gravelly loam, 5 to 20 percent slopes. This sloping to moderately steep soil is on narrow, steep escarpments where high terraces break to bottom lands or to low terraces. Areas are about 200 to 300 feet wide and range from about 10 to 15 acres in size. The slopes are single and short.

The surface layer is dark grayish-brown gravelly loam about 6 inches thick. It is about 20 to 25 percent, by volume, limestone and chert pebbles and caliche fragments. It is underlain by beds of limestone gravel and sand to a depth of 8 feet. The upper 2 to 10 inches of gravel has been cemented with lime into a hard platy layer.

Included with this soil in mapping are spots of Altoga and Quihi soils. Altoga soils are in about the same position as Queeny soils. Quihi soils are on the edge of the terraces above the escarpments. Also included are spots where the cemented upper part of the gravel bed is exposed at the surface. These spots are less than 2 acres in size.

Runoff is rapid. The hazard of water erosion is moderate. The soil is used mainly as a source of gravel for road construction. It is not suited to cultivated

Figure 16.—**Profile of Queeny gravelly loam, 1 to 5 percent slopes, showing the underlying gravel and sand.**

Quihi Series

The Quihi series consists of moderately deep, noncalcareous, gently sloping, gravelly loamy soils on uplands. These soils formed in very gravelly, loamy to clayey, ancient alluvial sediment.

In a representative profile the surface layer is dark grayish-brown gravelly loam about 12 inches thick. It is about 50 percent, by volume, limestone and siliceous pebbles that are mainly less than 3 inches in diameter. The next layer is 26 inches thick. The upper 16 inches is red, firm very gravelly clay and is about

caliche about 10 inches thick. Below this is a loose gravel bed.

Quihi soils are well drained. Runoff is medium. Permeability is moderately slow. Available water capacity is low. The hazard of water erosion is slight.

Representative profile of Quihi gravelly loam in an area of Quihi soils, 1 to 5 percent slopes, 11 miles north of Seguin on Texas Highway 123, 1.2 miles west on gravel road, then 100 feet north of road to gravel pit:

A1—0 to 12 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2)

Figure 18.—**Gravel pit on Quihi soils, 1 to 5 percent slopes. The underlying gravel beds are a good source of gravel.**

subject to overflow at least once each year. Other areas, protected by dams, are subject to overflow only about every 10 to 50 years. The hazard of water erosion is slight.

Representative profile of Seguin silty clay loam, 300 feet north of river channel in flood plain of Guadalupe River, 0.3 mile northeast of the Texas Highway 123 river bridge in Seguin:

A1—0 to 13 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, granular, and very fine, subangular blocky structure; hard, friable; com-
[redacted]

upper part; few films and threads of calcium carbonate; common ⅛- to 4-inch strata of very fine sandy loam, silt loam, and silty clay loam; calcium carbonate equivalent about 45 percent; calcareous; moderately alkaline.

The soil material is 18 to 30 percent silicate clay. Calcium carbonate equivalent ranges from 40 to 60 percent.

The A1 horizon ranges from 8 to 18 inches in thickness. It is dark grayish brown, dark brown, grayish brown, or brown.

The B2 horizon ranges from 5 to 24 inches in thickness. It is grayish brown, brown, or pale brown. The C horizon is light brownish gray, pale brown, or very pale brown. Texture of an individual stratum in the C horizon ranges from loamy very fine sand to silty clay, and a few strata are as

Figure 19.—**Profile of Seguin silty clay loam showing the dark layers deposited by floodwaters.**

Bosque and Trinity soils. Bosque soils are in about the same position as Seguin soils, and Trinity soils are in low areas of old channels. These spots are generally less than 2 acres in size and make up less than 15 percent of the mapped areas.

This soil is well suited to cultivated crops, improved [redacted] is moderate. Available water capacity is medium. The hazard of water erosion is slight to moderate.

Representative profile of Sunev loam, 1 to 3 percent slopes, 5 miles west of Seguin on Farm Road 78 to McQueeny, 4 miles northwest on Farm Road 725, 0.8 mile east on gravel road, then 300 feet into field south of road:

[redacted]

B3ca—21 to 60 inches, very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; strong, very fine, granular structure; slightly hard, very friable; few wormcasts and holes; many fine calcium-carbonate threads; few snail-shell fragments; calcium carbonate equivalent of 64 percent;

areas have a few gullies that are mainly 2 to 4 feet deep, 6 to 12 feet wide, and 200 to 600 feet apart. They make up about 10 to 20 percent of the mapped areas.

The surface layer is dark grayish-brown loam about 10 inches thick. The next layer is about 60 inches thick.

frequently flooded areas. They are subject to overflow for 1 to 2 days in spring or in fall about once every 7 to 10 years. The areas range from about 5 to 100 acres in size. Slopes have a gradient of less than 1 percent.

The soil, to a depth of 60 inches, is very dark gray, firm clay that has a few grayish-brown clay strata in the lower part. It is underlain, below a depth of 60 inches, by grayish-brown clay.

Included with this soil in mapping are a few slightly higher spots of Branyon soils that are not subject to flooding. Also included in places are a few spots of

weak, medium, blocky structure; very hard, firm; few fine roots; common fine pores; few, very thin, very pale brown, loamy fine sand strata; few, fine, iron-manganese concretions; few wormcasts; few snail shells on surface; mildly alkaline; abrupt, smooth boundary.

IIC—7 to 60 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; few, fine, faint, grayish-brown and yellowish-brown mottles; massive; slightly hard, friable; few fine roots; common fine pores; common grayish-brown sandy clay loam strata 0.5 to 1 inch thick; few pale-brown loamy fine sand strata about 1 inch thick; bedding planes

not suited to cultivated crops because of frequent flooding. Large trees provide shade for cattle and protection and food for wildlife. Capability unit Vw–1; Loamy Bottomland range site.

Vernia Series

The Vernia series consists of deep, noncalcareous, gently sloping, very gravelly sandy soils on uplands. These soils formed in thick beds of sand and gravel deposited by ancient streams.

In a representative profile the surface layer is very gravelly loamy sand about 44 inches thick. The upper part is pale brown and is 60 percent gravel; the lower part is very pale brown and is 80 percent gravel. The next layer is very firm, very gravelly and gravelly sandy clay loam 28 inches thick. The upper 12 inches is light gray and has red mottles. It is 70 percent, by volume, chert pebbles. The next 10 inches is light gray and red and has mottles. It is 35 percent, by volume, chert pebbles. The lower 6 inches, also mottled, is very pale brown, brownish yellow, and yellowish red. It is 20 percent, by volume, gravel. The underlying material, at a depth of 72 inches, is reddish-yellow gravelly sandy loam that is mottled in shades of red, gray, and yellow.

Vernia soils are well drained. Runoff is very slow, and permeability is moderate. Available water capacity is very low. The hazard of water erosion is slight.

Representative profile of Vernia very gravelly loamy sand, 1 to 5 percent slopes, 9 miles east of Seguin on U.S. Highway 90 to Kingsbury, 4 miles northeast of Kingsbury on gravel road, then 400 feet southeast of

and pebbles; few, fine, iron-manganese concretions; very strongly acid; gradual, smooth boundary.

C—72 to 80 inches, reddish-yellow (7.5YR 6/6) gravelly sandy loam, strong brown (7.5YR 5/6) moist; common, medium, distinct, light-gray, red, and yellow mottles; massive; very hard, firm, nonsticky; about 40 percent, by volume, siliceous pebbles that are mainly less than 1 inch in diameter; few, fine, iron-manganese concretions; very strongly acid.

The solum ranges from 60 to 110 inches in thickness. The A horizon ranges from 40 to 80 inches in thickness. Reaction ranges from slightly acid to mildly alkaline. The A horizon is brown, pale brown, very pale brown, grayish brown, or light brownish gray. It is 60 to 85 percent, by volume, siliceous pebbles and cobbles.

The B horizon is mottled and is dominantly light gray, light brownish gray, pale brown, brown, yellowish red, or red; or it is mottled in shades of red, gray, yellow, and brown. The B horizon is gravelly or very gravelly sandy loam or sandy clay loam. The upper 20 inches is 18 to 32 percent clay and 35 to 80 percent pebbles and cobbles. Reaction is medium acid to very strongly acid. The C horizon is mottled, red, gray, and yellow gravelly sandy loam to very gravelly sandy loam or very gravelly sandy clay loam.

VrC—Vernia very gravelly loamy sand, 1 to 5 percent slopes. This gently sloping soil is on broad ridges. Areas mainly have a broad, irregular shape, and most are several hundred acres in size. Slopes are convex and have a gradient that averages about 2 percent.

Included with this soil in mapping are spots of Crockett, Quihi, and Darst soils. Crockett soils are in low areas. Quihi soils are on small knolls. Darst soils are on the more sloping parts of the ridges. These spots are generally less than 3 acres in size and make up less than 15 percent of the mapped areas.

This soil is better suited to native range, to recreation, and as a source of road fill material [illegible]

B21t—8 to 19 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; few, fine, prominent, yellowish-brown mottles in lower part; moderate, medium, blocky structure; extremely hard, very firm; few fine roots; few fine pores; thick, continuous clay films on ped faces; slightly acid; gradual, smooth boundary.

B22t—19 to 36 inches, prominently mottled, red (2.5YR 4/6) and yellowish-brown (10YR 5/8) clay; moderate, medium, blocky structure; extremely hard, very firm; few fine roots; few fine pores; thick, continuous clay films on ped faces, medium acid; gradual, smooth boundary.

B3—36 to 48 inches, prominently mottled, red (2.5YR 4/6), yellowish-brown (10YR 5/8), and pale-brown (10YR 6/3) sandy clay loam; weak, medium,

cent of most mapped areas. In other areas the surface layer ranges from about 4 to 8 inches in thickness. Gullies that are about 2 to 6 feet deep, 4 to 20 feet wide, and 200 to 500 feet apart make up about 25 to 30 percent of most mapped areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are spots of Demona soils in a concave position below Windthorst soils and Crockett soils in about the same position as Windthorst soils. These spots are less than 3 acres in size and make up less than 15 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

CAPABILITY UNIT I–1

This unit consists of deep, well-drained, moderately permeable, nearly level silty clays and silty clay loams

[redacted]

These soils respond well to fertilizers, but fertilizers should be applied for cultivated crops and pasture [redacted] protect the soil from erosion. Diversion terraces and grassed waterways help control runoff from higher [redacted]

plants during grazing periods, fertilization, weed and brush control, and an adequate water supply for livestock. The soil responds well to added fertilizers, but fertilizers should be applied as recommended by soil

helps to protect the soil from erosion, increase water intake, conserve moisture, and maintain organic-matter content and tilth. Grassed waterways and di-

test.

CAPABILITY UNIT IIs–1

This unit consists of deep, well-drained, moderately permeable to slowly permeable, nearly level silty clays to loams on terraces.

These soils are well suited to cultivated crops and

runoff from surrounding areas and provide outlets for terraces. The soils respond well to added fertilizers, but fertilizers, should be applied as recommended by soil test. Rotational grazing, weed and brush control, maintenance of proper height of forage plants during grazing periods, fertilization, and an adequate water supply for livestock are needed for pasture. Some areas

ment of plant roots, water, and air through the dense clayey lower layers is slow to very slow.

The cropping system should include grain sorghum or corn, which produce large amounts of residue. Returning crop residue to the soil helps to control

matter content and tilth. Good pasture management requires rotational grazing, weed and brush control, maintenance of proper height of forage plants during grazing periods, fertilization, and an adequate supply of water for livestock. Soil test recommendations should

CAPABILITY UNIT IVe–1

Austin silty clay, 3 to 5 percent slopes, eroded, is the only soil in this unit. It is a moderately deep, well drained, moderately slowly permeable, gently slop[redacted] but fertilizers should be applied as recommended by[redacted] areas require brush clearing and shaping, smoothing, and filling of gullies before pasture grasses are planted or sprigged. The soils respond well to added fertilizers.

blowing in fall, winter, and spring. These soils respond to small, frequent applications of fertilizers, but fertilizers should be applied as recommended by soil test.

by establishing a plant cover. Many areas require shaping, smoothing, and filling of gullies before pasture grasses can be seeded or sprigged. Diversion terraces

A good vegetative cover should be maintained to help

pasture and range to maintain a good cover. Pasture grass grows best when fertilized according to soil test.

Range Sites and Condition Classes

Different kinds of soil vary in their capacity to produce grass and other plants for grazing. Soils that

TABLE 2.—*Predicted yields per acre of principal crops*

[Absence of yield indicates that the crop is not suited to or is not commonly grown on the soil]

Soil	Cotton (Lint)	Corn	Grain sorghum	Watermelons	Peanuts
	Lb	*Bu*	*Lb*	*Lb*	*Lb*
Altoga silty clay, 3 to 5 percent slopes, eroded	200	25	2,500		
Altoga silty clay, 5 to 12 percent slopes, eroded					
Arenosa fine sand, 1 to 8 percent slopes				3,500	900
Austin silty clay, 1 to 3 percent slopes	250	25	3,000		
Austin silty clay, 3 to 5 percent slopes, eroded	200	20	2,000		
Barbarosa silty clay, 0 to 1 percent slopes	350	50	4,500		
Barbarosa silty clay, 1 to 3 percent slopes	300	45	3,750		
Bosque and Seguin soils, frequently flooded					
Branyon clay, 0 to 1 percent slopes	450	60	5,000		
Branyon clay, 1 to 3 percent slopes	450	55	4,500		
Burleson clay, 0 to 1 percent slopes	450	55	4,500		
Burleson gravelly clay, 0 to 1 percent slopes	450	55	4,500		
Burleson gravelly clay, 1 to 3 percent slopes	400	50	4,000		
Crockett fine sandy loam, 0 to 1 percent slopes	375	40	3,000		750
Crockett fine sandy loam, 1 to 3 percent slopes	325	35	2,750		725
Crockett gravelly sandy loam, 1 to 5 percent slopes		25	2,250		
Crockett loam, 2 to 5 percent slopes, eroded		25	2,500		

medium grasses. Little bluestem is dominant in the plant community, and indiangrass and big bluestem are subdominant. Numerous other grasses are in the potential plant community in fewer places or in smaller amounts. Many palatable forbs and legumes are native

of the climax plant community is little bluestem, 50 percent; indiangrass, 20 percent; Texas wintergrass, 5 percent; vine-mesquite, 5 percent; other grasses, 15 percent; perennial forbs and a few woody plants, 5 percent.

The site produces approximately 4,000 pounds of air-dry herbage per acre in unfavorable years and 8,000 pounds in favorable years. Approximately 95 percent of this is forage for livestock.

Under continued heavy grazing, little bluestem, indiangrass, big bluestem, switchgrass, Maximillian sunflower, and englemanndaisy decrease in the plant community. Such plants as silver bluestem, Texas wintergrass, tall dropseed, side-oats grama, and less palatable forbs increase. If overgrazing is prolonged,

indiangrass decrease in the plant community. Grasses such as vine-mesquite and meadow dropseed increase. If overgrazing is prolonged, buffalograss and annual grasses and weeds increase.

CLAYPAN PRAIRIE RANGE SITE

This site consists of deep, moderately well drained to somewhat poorly drained, very slowly permeable, nearly level to sloping fine sandy loams, gravelly sandy loams, or loams on uplands. Available water capacity is medium to high. The hazard of water erosion is slight to severe.

[redacted]

cover can be managed by mechanical and chemical means.

ERODED BLACKLAND RANGE SITE

This site consists of deep, well-drained, very slowly permeable, sloping to moderately steep clays on uplands. Available water capacity is high. The hazard of water erosion is severe.

The natural potential plant community is grasses that vary because of soil blowing. The approximate composition, by weight, of the climax plant community is little bluestem, 40 percent; indiangrass, 15 percent; vine-mesquite, 10 percent; silver bluestem, 10 per-

Figure 21.—**Little bluestem in an area of Patilo and Arenosa soils, 1 to 8 percent slopes, in Deep Savannah range site.**

cent; knotroot panicum, plains bristlegrass, and fall witchgrass, 10 percent; fringeleaf paspalum and hooded windmillgrass, 10 percent; forbs such as bush sunflower, orange zexminia, snoutbean, western indigo and gayfeather, 5 percent; and woody plants such as live oak, post oak, and hackberry, 5 percent.

The site produces approximately 2,000 pounds of air-dry herbage per acre in unfavorable years and 4,000 pounds in favorable years. Approximately 80 percent of this is forage for livestock.

Under continued heavy grazing, bluestem, indiangrass, and crinkleawn decrease. Fringeleaf paspalum and hooded windmill increase, and annual forbs become abundant. Mesquite and pricklypear commonly invade the site.

lovegrass, 15 percent; silver bluestem, 10 percent; fringeleaf paspalum, three-awn, and windmillgrass, 10 percent; post oak, blackjack, and catclaw acacia, 15 percent; and sensitivebriar, snoutbean, aster, knotweed, leaf-flower, and annuals, 5 percent.

The site produces approximately 2,000 pounds of air-dry herbage per acre in unfavorable years and 3,500 pounds in favorable years. Approximately 80 percent of this is forage for livestock.

Under heavy grazing, bluestem, indiangrass, and sand lovegrass decrease. Three-awn, red lovegrass, gummy lovegrass, and annual forbs increase and dominate the site.

SANDY LOAM RANGE SITE

This site consists of moderately deep to [illegible]

percent; post oak and live oak, 5 percent; and forbs such as western indigo, bundleflower, and zexmenia, 5 percent.

The site produces approximately 2,000 pounds of air-dry herbage per acre in unfavorable years and 3,500 pounds in favorable years. Approximately 80 percent of this is forage for livestock.

Under continued heavy grazing, bluestem grass decreases, and plants such as hooded windmill grass and annuals increase. Mesquite, huisache, and whitebrush are woody plants that invade. These woody plants can be managed by mechanical and chemical means.

VERY GRAVELLY RANGE SITE

This site consists of deep, well-drained, moderately permeable, gently sloping very gravelly loamy sands on uplands. Available water capacity is very low. The hazard of erosion is slight.

The natural potential plant community is an open stand of post oaks and a mixture of mid and tall grasses and forbs. The approximate composition, by weight, of the climax plant community is little bluestem, 40 percent; brownseed paspalum and beaked panicum, 20 percent; tall dropseed, 10 percent; low panicums,

of surface layer, available water capacity to a depth of 40 inches, wetness, surface stoniness or rockiness, flood hazard, slope, and permeability.

In table 3 soils of Guadalupe County are rated for producing seven elements of wildlife habitat and for three groups, or kinds, of wildlife. The ratings indicate relative suitability for various elements.

A rating of good means the element of wildlife habitat and habitats generally are easily created, improved, and maintained. Few or no limitations affect management in this category and satisfactory results are expected if the soil is used for the prescribed purpose.

A rating of fair means the element of wildlife habitat and habitats can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequent attention are required for satisfactory results, however.

A rating of poor means the elements of wildlife and limitations for the designated use are rather severe. Habitats can be created, improved, or maintained in most places, but management is difficult and requires intensive effort.

A rating of very poor means the element of wildlife habitat and limitations for the designated use are

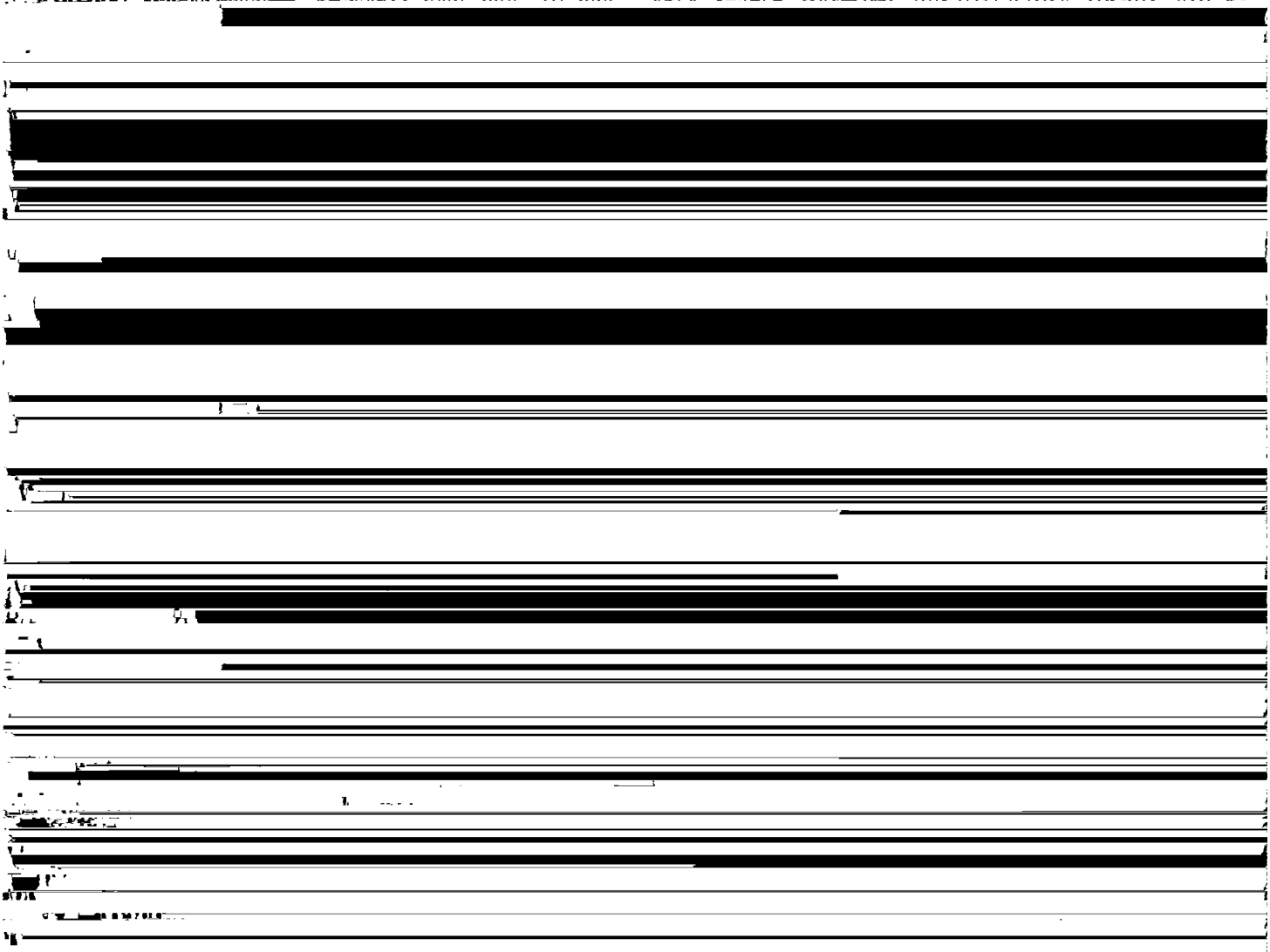


Figure 22.—**Fishing and recreation area of the Guadalupe River on Seguin soils.**

wet sites. They furnish food and cover mostly for [redacted] mally live in meadows, pastures, and open areas where [redacted]

TABLE 3.—*Interpretations of the soils for elements*

Soil series and map symbols	Elements of wildlife habitat		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants
Altoga:			
AlC3	Fair	Good	Poor
AlE3	Poor	Fair	Poor
Arenosa: ArD	Poor	Poor	Fair
Austin: AuB, AuC3	Fair	Good	Poor
Barbarosa: BaA, BaB	Good	Good	Poor
Bosque: Bo	Very poor	Poor	Fair
For Seguin part, see Seguin series.			
Branyon: BrA, BrB	Good	Good	Poor
Burleson: BuA, ByA, ByB	Good	Good	Poor
Crockett:			
CfA	Fair	Fair	Good
CfB	Fair	Good	Good
CgC, CsC3	Fair	Good	Good
CsD4	Poor	Fair	Good
Darst: DgE	Poor	Fair	Good
Demona: DmC	Fair	Good	Good
Doss: DoB	Fair	Good	Poor
Eddy: EgC	Poor	Fair	Poor
Ferris: FhF3	Poor	Fair	Poor
For Heiden part, see Heiden series, unit HeD3.			
Heiden:			
HeB	Good	Good	Poor
HeC, HeC3, HeD3	Fair	Good	Poor
Houston Black:			
HoA, HoB, HpB	Good	Good	Poor
HpC	Fair	Good	Poor
Jedd	Poor	Fair	Good
Mapped only in complex with Nebgen soils.			
Lewisville: LeA, LeB	Good	Good	Poor
Mabank:			
MaA	Fair	Fair	Good
MaB, MaB3	Fair	Good	Good
Nebgen: NcF	Very poor	Very poor	Poor
For Jedd part, see Jedd series.			
Patilo: PaD	Poor	Poor	Good
For Arenosa part, see Arenosa series.			
Queeny: QeC, QeF	Poor	Poor	Poor
Quihi: QgC	Poor	Poor	Fair
Seguin:			
Se	Good	Good	Fair
Bo (Seguin part)	Very poor	Poor	Fair
Sunev:			
SuA, SuB	Good	Good	Good
SuC3	Fair	Good	Good

of wildlife habitat and for kinds of wildlife

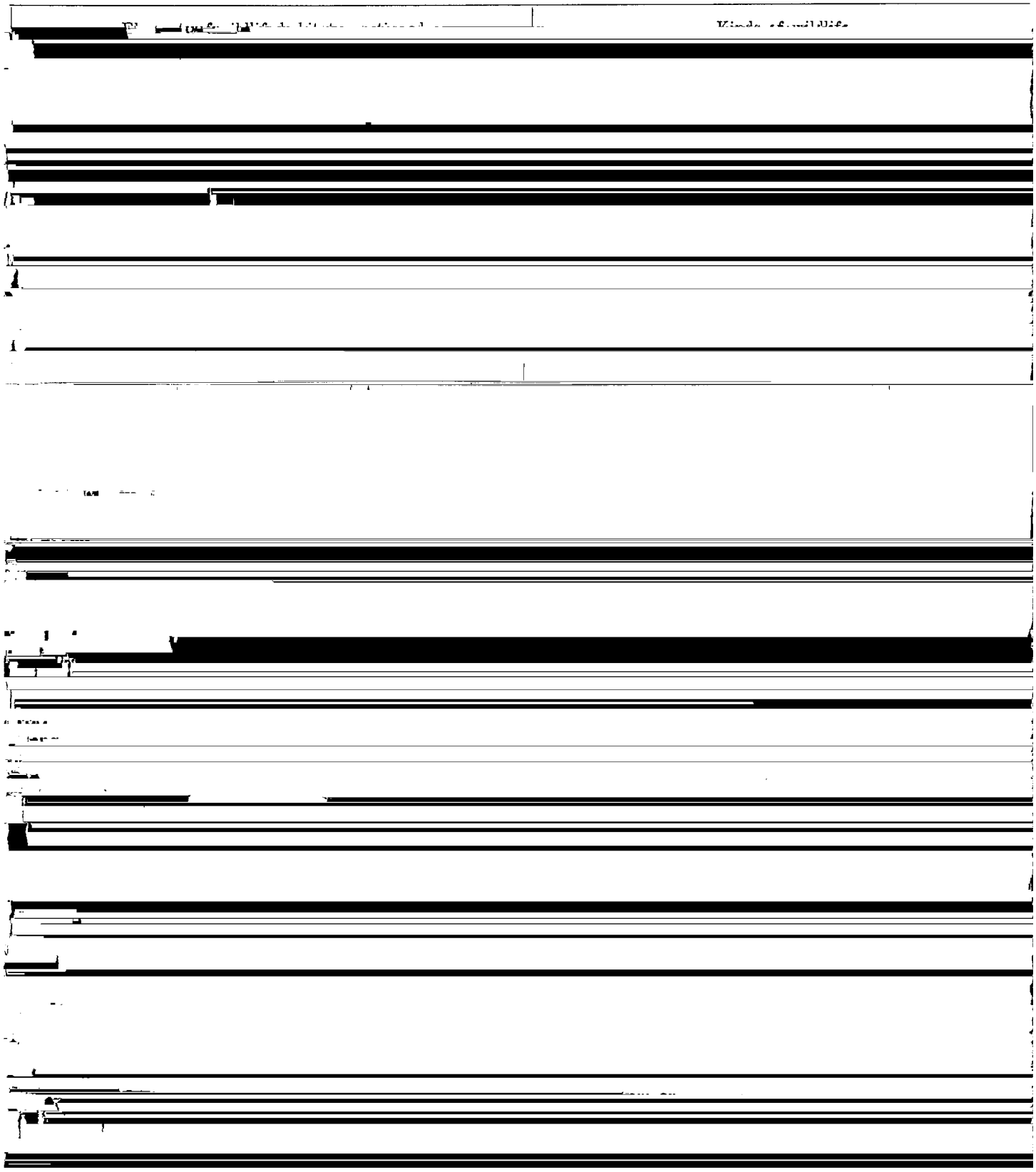


TABLE 3.—*Interpretations of the soils for elements*

Soil series and map symbols	Elements of wildlife habitat		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants
Trinity:			
Tr	Good	Good	Poor
Tw	Very poor	Poor	Poor
Uhland:			
Uh	Good	Good	Good
Uw	Very poor	Poor	Fair
Vernia: VrC	Poor	Poor	Fair
Windthorst:			
WdB	Good	Good	Good
WdC3	Fair	Good	Good

moderate, or severe limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they easily can be overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these, is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking

15 percent, and have few or no rocks or stones on the surface.

Use of the Soils for Gardening and Landscaping

Suburban homeowners and others who garden and landscape need to know the suitability and limitations of soils for growing flowers, shrubs, trees, fruits, and vegetables.

In tables 5, 6, 7, and 8 the soils of Guadalupe County are grouped according to texture, reaction, and other characteristics that affect suitability for garden and

of wildlife habitat and for kinds of wildlife—Continued

Elements of wildlife habitat—continued			Kinds of wildlife		
Shrubs	Wetland food and cover plants	Shallow-water developments	Open land	Rangeland	Wetland
Fair	Poor	Poor	Fair	Poor	Poor.
Fair	Poor	Fair	Poor	Poor	Poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Fair	Fair	Poor	Fair	Fair.
Good	Poor	Very poor	Poor	Fair	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.

Engineering Uses of the Soils[3]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 9, 10, and 11, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Also, inspection of sites, especially small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have

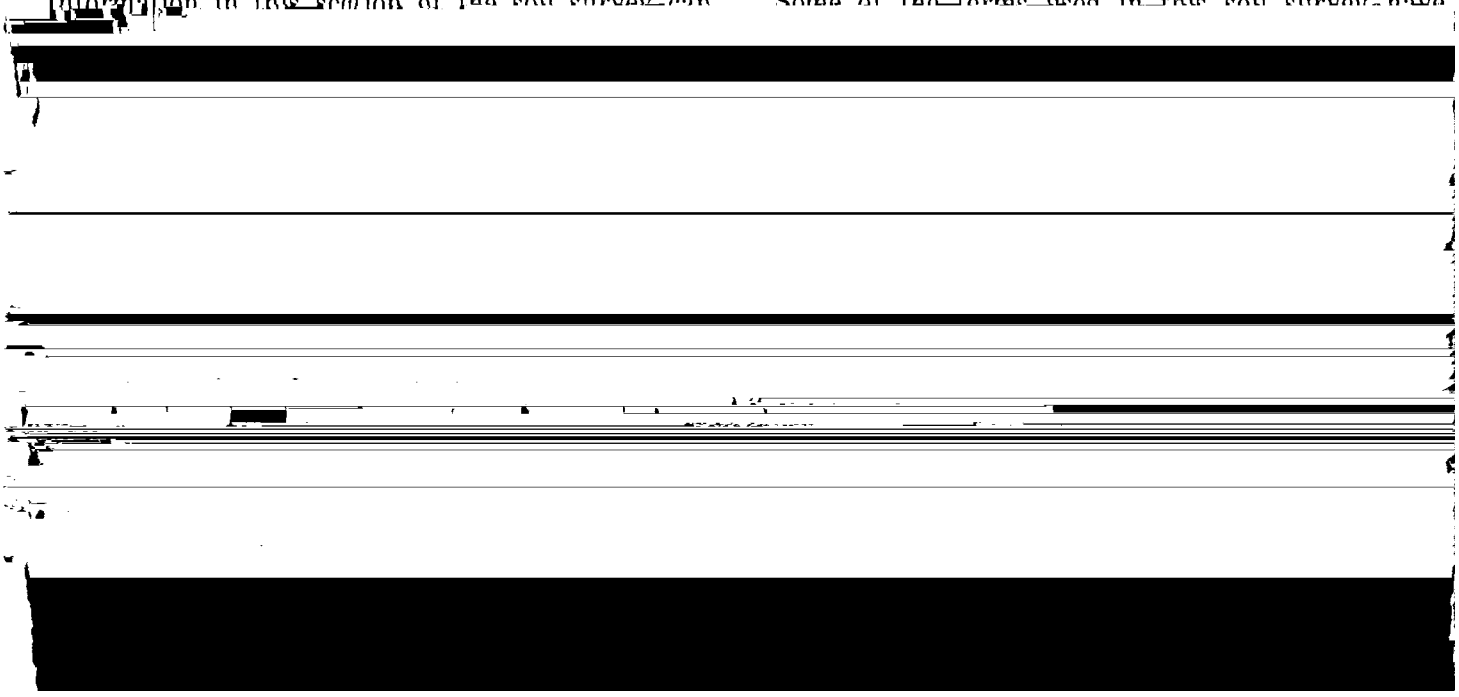


TABLE 4.—*Limitations of the soils for recreational development*

[Limiting soil features are defined in the Glossary. See text for defi

TABLE 4.—*Limitations of the soils for recreational development*—Continued

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Quihi: QgC	Moderate: percs slowly; small stones.	Moderate: small stones.	Moderate: percs slowly; small stones.	Moderate: small stones.
Seguin: Se	Severe: floods	Moderate: floods; too clayey.	Severe: floods	Moderate: too clayey.
Sunev: SuA, SuB	Slight	Slight	Slight	Slight.

TABLE 5.—*Suitability of the soils for flowers*

[Absence of data indicates that flowers are not rated for the soil group]

Soil groups and map symbols	Good	Fair	Poor
Group 1: Deep, neutral to slightly	Agapanthus, anemone, aster	Amaryllis, aster (annual),	Bird-of-paradise, chrysanthe-

TABLE 6.—*Suitability of the soils for shrubs*

[A dash in the column indicates that shrubs are not rated for this soil group]

Soil groups and map symbols	Good	Fair	Poor
Group 1:			

TABLE 7.—*Suitability of the soils for trees*

Soil groups and map symbols	Good	Fair	Poor
Group 1: Deep, neutral to slightly acid, moderately well drained to well drained loamy fine sands, fine sands, and very gravelly loamy sands. ArD, DmC, PaD, VrC.	Arborvitae, ash (Arizona), capejasmine, cedrus deodara, cherry (flowering), crabapple (flowering), crapemyrtle, dogwood, elm (American), Halepensis, Japanese black pine, live oak, magnolia, peach, pecan, plum, sycamore.		
Group 2:	Arborvitae, ash (Arizona)	Cedrus deodara [1]	Capejasmine, cherry (flower-

[1]

TABLE 8.—*Suitability of the soils for vegetables and fruits*

[Absence of data indicates that vegetables are not rated for the soil group]

Soil groups and map symbols	Good	Fair	Poor
Group 1: Deep, neutral to slightly acid, moderately well drained to well drained loamy fine sands, fine sands, and very gravelly loamy sands. ArD, DmC, PaD, VrC.	Watermelon	Asparagus, bean, beet, blackberry, broccoli, brussel sprout, cabbage, cantaloupe, carrot, cauliflower, cucumber, lettuce, mustard, okra, onion, parsley, pea, pepper, Irish potato, sweet potato, pumpkin, radish, spinach, squash, strawberry, sweet corn, tomato, turnip.	
Group 2: Moderately deep to deep, mildly alkaline to moderately alkaline, well-drained loams, silty clay loams, and silty clays. AlC3, AlE3, AuB, AuC3, BaA, BaB, Bo, LeA, LeB, Se, SuA, SuB, SuC3.	Blackberry, broccoli, cabbage, cantaloupe, cauliflower, cucumber, onion, parsley, pea, radish, spinach, squash, sweet corn, tomato.	Bean, beet, brussel sprout, carrot, lettuce, okra, pepper, Irish potato, pumpkin, strawberry, turnip.	Asparagus, sweet potato, mustard, watermelon.
Group 3: Deep, slightly acid to mildly alkaline, moderately well drained to somewhat poorly drained fine sandy loams, clay loams, and loams. CfA, CfB, CgC, CsC3, CsD4, MaA, MaB, MaB2		Asparagus, bean, beet, blackberry, broccoli, brussel sprout, cabbage, cantaloupe, carrot, cauliflower, cucumber, lettuce, mustard, okra, onion, parsley, pea, pepper, Irish potato, sweet potato, pumpkin, radish, spinach, squash	

TABLE 9.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The instructions for referring to other series that appear in the first column of this table. Absence of data indicates that the

Soil series and map symbols	Hydrologic group	Depth to rock	Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
					Unified	AASHTO	
		In	*In*				*Pct*
Altoga: AlC3, AlE3	C	>60	0–7	Silty clay	CL or CH	A–6, A–7–6	
			7–20	Silty clay	CL or CH	A–7–6, A–6	
			20–35	Silty clay	CL	A–7–6, A–6	
			35–72	Silty clay	CL	A–7–6, A–6	

significant to engineering

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Pct		*In per hr*	*In per in of soil*	*pH*			
100	95–100	85–100	80–95	40–51	20–31	0.6–2.0	0.15–0.18	7.9–8.4	High		
		100	95–100	40–51	20–31	0.6–2.0	0.15–0.18	7.9–8.4	High	Moderate	Low.
		100	95–99	30–48	20–25	0.6–2.0	0.15–0.18	7.9–8.4	Moderate	Moderate	Low.
		100	95–99	30–48	15–30	0.6–2.0	0.13–0.17	7.9–8.4	Low	Moderate	Low.

TABLE 9.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth to rock	Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
					Unified	AASHTO	
		In	*In*				*Pct*
Demona: DmC	C	>60	0–24	Loamy fine sand	SM, SM-SC	A-2-4	
			24–60	Clay, sandy clay	CH, CL	A-7-6	
Doss: DoB	C	12–20	0–15	Silty clay, clay loam	MH	A-7-6	0–5
			15–20	Platy chalk.			
Eddy: EgC	C	3–10	0–4	Gravelly clay loam	GC	A-6, A-2	5–20
			4–10	Platy chalk.			
*Ferris: FhF3 For Heiden part, see Heiden series.	D	>60	0–60	Clay, shaly clay	CH	A-7-6	
Heiden: HeB, HeC, HeC3, HeD3	D	>60	0–84	Clay, shaly clay	CH	A-7-6	
Houston Black:							
HoA, HoB	D	>60	0–60	Clay	CH	A-7-6	
HpB, HpC	D	>60	0–12	Gravelly clay	GC, CH	A-2-7, A-7-6	0–5
			12–60	Clay	CH	A-7-6	
Jedd Mapped only in complex with Nebgen soils.	C	20–26	0–10	Cobbly sandy loam	GM, SM, SM-SC, GP-GM, SP-SM, GM-GC	A-2-4	5–50
			10–24	Sandy clay	CL, SC	A-7-6, A-6	

significant to engineering—Continued

[redacted]

TABLE 9.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth to rock	Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
					Unified	AASHTO	
		In	*In*				*Pct*
Trinity: Tr, Tw	D	>60	0–72	Clay	CH	A–7–6	
Uhland: Uh, Uw	B	>60	0–7	Clay loam	CL	A–6, A–7	0–10
			7–60	Fine sandy loam	SC, CL, CL–ML, SM–SC	A–4, A–6	0–10
Vernia: VrC	A	>60	0–44	Very gravelly loamy sand.	GP–GM	A–1	5–10
			44–72	Very gravelly or gravelly sandy clay loam.	GC, SC	A–2–6, A–2–7	2–5
			72–80	Gravelly sandy loam	GC, SC	A–2–6	2–5
Windthorst: WdB, WdC3	C	>60	0–8	Fine sandy loam	SM, SM–SC	A–4, A–2–4	
			8–36	Clay	CH, CL	A–7–6, A–6	
			36–72	Sandy clay loam	SC, CL	A–6, A–7–6	

[1] Nonplastic.

to transmit water or air. It is estimated on basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 9 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the [illegible]

uncoated steel or concrete. Rate of corrosion of uncoated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil [illegible]

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Pct		*In per hr*	*In per in of soil*	*pH*			
100	98–100	85–100	80–95	51–60	30–40	<0.06	0.15–0.20	7.4–8.4	Very high--	Very high--	Low.
95–100	95–100	95–100	70–90	35–45	18–25	0.2–0.6	0.15–0.20	6.1–7.8	Moderate --	Moderate --	Low.
95–100	90–100	80–100	44–90	25–35	5–12	0.2–0.6	0.10–0.14	6.1–7.8	Very low---	Moderate --	Low.
10–44	10–27	10–15	6–10	--------	NP	6.0–20.0	0.03–0.06	6.1–7.8	Very low---	Low -------	Low.
30–65	13–50	13–45	13–31	35–45	18–30	0.6–2.0	0.08–0.13	4.5–6.0	Very low---	Low -------	Low.
20–55	15–50	15–40	15–25	25–35	12–20	0.6–2.0	0.05–0.10	4.5–6.0	Very low---	Low -------	Low.
95–100	90–100	75–95	21–45	<21	NP–7	0.6–2.0	0.12–0.17	5.6–7.3	Low -------	High ------	Low.
95–100	95–100	85–100	51–90	35–55	20–35	0.2–0.6	0.15–0.20	5.6–7.8	High ------	High ------	Low.
90–100	90–100	75–100	36–85	30–45	16–30	0.2–0.6	0.15–0.20	6.1–8.4	Moderate --	High ------	Low.

ponds and reservoirs, embankments, and terraces and diversions. For these particular uses, table 10 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means soil properties are generally favorable for the rated use, or in other words

pacted soil material. The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, content of organic matter, and slope; and, if the floor needs to be leveled, depth to bedrock becomes important. The

TABLE 10.—*Interpretations of engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The instructions for referring to other series that appear in the first column of this table. "Shrink-swell" and some of the other terms and other terms

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill	Local roads and streets
Altoga: AlC3	Moderate: seepage.	Moderate: slope.	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: shrink-swell.
AlE3	Moderate: seepage; slope.	Severe: slope.	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: shrink-swell.
Arenosa: ArD	Slight [1]	Severe: seepage.[1]	Severe: cut-banks cave.	Slight	Severe: seepage.[1]	Slight
Austin: AuB, AuC3	Severe: depth to rock; percs slowly.	Severe: depth to rock.	Moderate: depth to rock.	Severe: shrink-swell.	Severe: depth to rock; too clayey.	Severe: shrink-swell.
Barbarosa: BaA, BaB	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
*Bosque: Bo For Seguin part, see Seguin series.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Branyon: BrA, BrB	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
Burleson: BuA, ByA, ByB	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
Crockett: CfA, CfB	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.

properties of the soils

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," used to rate soils]

Degree and kind of limitation for—continued		Suitability as a source of—				Soil features affecting—		
Pond reservoir areas	Dikes, levees, and other embankments	Road fill	Sand	Gravel	Topsoil	Drainage for crops and pastures	Irrigation	Terraces and diversions
Moderate: seepage.	Moderate: piping.	Poor: shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Slope	Slope	Slope.
Moderate: seepage.	Moderate: piping.	Poor: shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Slope	Slope	Slope.
Severe: seepage.	Severe: erodes easily; piping.	Good	Fair: excess fines.	Improbable source.	Poor: too sandy.	Not needed	Droughty; fast intake; seepage.	Not needed.
Severe: depth to rock.	Moderate: thin layer.	Poor: shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Not needed	Percs slowly; slope.	Favorable.
Moderate: seepage.	Moderate: shrink-swell.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.[2]	Poor: too clayey.	Not needed	Percs slowly	Favorable.
Moderate: seepage.	Moderate: compressible.	Fair: low strength.	Improbable source.	Improbable source.	Good	Floods	Floods	Not needed.
Slight	Moderate: compressible.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Favorable	Percs slowly	Favorable.
Slight	Moderate: compressible.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Favorable	Percs slowly	Favorable.
Slight	Moderate: erodes easily.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: thin layer.	Favorable	Percs slowly	Favorable.
Slight	Moderate: erodes easily.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: thin layer.	Slope	Percs slowly; slope.	Slope.
Slight	Moderate: erodes easily.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: small stones.	Small stones; slope.	Percs slowly; slope.	Small stones.
Severe: depth to rock.	Moderate: thin layer.	Poor: low strength; thin layer.	Improbable source.	Improbable source.	Poor: small stones.	Depth to rock; slope.	Rooting depth; slope.	Rooting depth; slope.
Moderate: seepage.	Moderate: erodes easily; piping.	Poor: low strength.	Fair: excess fines.	Improbable source.	Poor: too sandy.	Not needed	Droughty; fast intake.	Erodes easily.

TABLE 10.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption	Sewage	Shallow	Dwellings without	Sanitary	Local roads

properties of the soils—Continued

Degree and kind of limitation for—continued		Suitability as a source of—				Soil features affecting—		
Pond reservoir areas	Dikes, levees, and other embankments	Road fill	Sand	Gravel	Topsoil	Drainage for crops and pastures	Irrigation	Terraces and diversions
Severe: depth to rock; seepage.	Moderate: thin layer.	Poor: low strength; thin layer.	Improbable source.	Improbable source.	Poor: excess lime; too clayey.	Not needed--	Droughty; percs slowly; rooting depth.	Rooting depth.
Severe: depth to rock.	Severe: depth to rock.	Poor: thin layer.	Improbable source.	Improbable source.	Poor: small stones.	Not needed--	Droughty; rooting depth; slope.	Rooting depth.
Slight ------	Moderate: shrink-swell; unstable fill.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Not needed--	Percs slowly; slope.	Slope.
Slight ------	Moderate: shrink-swell; unstable fill.	Poor: shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Not needed--	Percs slowly; slope.	Favorable.
Slight ------	Moderate: erodes easily; shrink-swell.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Not needed--	Percs slowly; slope.	Favorable.
Slight ------	Moderate: erodes easily; shrink-swell.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Not needed--	Percs slowly; slope.	Favorable.
Severe: depth to rock.	Moderate: piping.	Poor: large stones; thin layer.	Improbable source.	Improbable source.	Poor: large stones; small stones.	Not needed--	Droughty; rooting depth; slope.	Depth to rock; rock outcrops; slope.
Moderate: seepage.	Moderate: shrink-swell; unstable fill.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Not needed--	Favorable --	Favorable.
Slight ------	Moderate: shrink-swell; unstable fill.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: thin layer.	Percs slowly; wet.	Percs slowly; wet.	Favorable.
Severe: depth to rock.	Moderate: piping; unstable fill.	Poor: thin layer.	Improbable source.	Improbable source.	Poor: thin layer.	Not needed--	Droughty; rooting depth.	Depth to rock; large stones; rooting depth.
Severe:	Moderate:	Good	Fair: ex-	Improbable	Poor: too	Not needed	Droughty;	Erodes

TABLE 10.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption	Sewage lagoons	Shallow excavations	Dwellings without	Sanitary landfill	Local roads and streets

properties of the soils—Continued

Degree and kind of limitation for—continued		Suitability as a source of—				Soil features affecting—		
Pond reservoir areas	Dikes, levees, and other embankments	Road fill	Sand	Gravel	Topsoil	Drainage for crops and pastures	Irrigation	Terraces and diversions
Severe: depth to rock.	Severe: piping; thin layer.	Poor: thin layer.	Improbable source.	Good	Poor: small stones.	Not needed	Droughty; rooting depth; seepage.	Depth to rock; piping; rooting depth.
Severe: seepage.	Moderate: compressible; piping.	Severe: low strength.	Improbable source.	Improbable source.	Poor: excess lime.	Floods	Floods	Not needed.
Severe:	Moderate:	Fair: low	Improbable	Improbable	Poor: ex-	Good	Excess lime;	Not needed.

TABLE 11.—*Engineering*

[Absence of data indicates that no determination was made. Tests performed by

Soil name and location	Parent material	Report No.	Depth	Shrinkage			Percent of liquid limit volume
				Limit	Linear	Ratio	
			Inches				
Altoga silty clay:							
[illegible] west of Sequit on Farm Road 78	Silty clay of Taylor	68–360–R	0–7	17	10.9	1.80	29.3

test data

Texas Highway Department, Materials and Testing Division, Camp Hubbard, Austin]

Mechanical analysis [1]												Liquid limit	Plasticity index	Classification	
Percentage passing sieve—									Percentage smaller than—						
					No. 4	No. 10	No. 40	No. 200							

TABLE 11.—*Engineering*

Soil name and location	Parent material	Report No.	Depth	Shrinkage			Percent of liquid limit volume
				Limit	Linear	Ratio	
			Inches				
Queeny loam:							
1.5 miles east of Seguin on U.S. Highway 90–A, 0.2 mile south on paved road, then 400 feet west of road to west side of gravel pit. (Modal)	Loamy and gravelly alluvium of the Guadalupe River.	70–79–R	0–7	18	8.5	1.79	----------
		70–80–R	7–144	17	4.8	1.84	----------
Seguin silty clay loam:							
500 feet east of Texas Highway 123 on north side of Guadalupe River bridge in Seguin. (Modal)	Loamy alluvium of Guadalupe River.	69–30–R	0–13	21	8.3	1.72	----------
		69–31–R	13–60	23	8.2	1.70	----------
Sunev loam:							
5 miles northwest of McQueeny on Farm Road 725, 1 mile northeast on gravel road, then 300 feet into field south of road. (Modal)	Loamy alluvium of Guadalupe River.	68–567–R	0–11	17	5.1	1.85	14.5
		68–568–R	11–21	17	7.2	1.85	20.1
		68–569–R	21–60	17	5.5	1.82	15.6
Windthorst fine sandy loam:							
7 miles south of Seguin on Texas Highway 123, 2 miles east on paved road, then 50 feet into pasture south of road. (Modal)	Interbedded sand and clay of the Wilcox Formation.	68–349–R	0–8	20	0.7	1.67	2.1
		68–350–R	8–19	16	16.3	1.85	41.2
		68–351–R	19–36	17	14.3	1.82	37.1
		68–352–R	36–48	20	7.7	1.74	21.4

[1] Mechanical analysis according to the AASHTO Designation T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the Soil Survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-sized fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-sized fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and does not require excessive management to produce a cover of plants.

Engineering Test Data

Table 11 contains engineering test data for some

maximum dry density. As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

Shrinkage limit is the percentage of moisture at which shrinkage of the soil material stops.

Shrinkage ratio is the relation of change in volume of the soil material to the water content of the soil material when at the shrinkage limit. The change in volume is expressed as a percentage of the air-dry volume of the soil material, and the water content is expressed as a percentage of the weight of the soil material when oven-dry

test data—Continued

Mechanical analysis [1]												Liquid limit	Plasticity index	Classification	
Percentage passing sieve—									Percentage smaller than—						
2 in	1¼ in	⅞ in	⅝ in	⅜ in	No. 4 (4.0 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm			AASHTO [2]	Unified [3]
												Percent			
100	93	89	87	85	84	83	81	44	37	18	15	36	16	A-6(4)	SC
100	98	87	67	47	29	22	14	7	7	4	3	26	12	A-2-6(0)	GW-GC
------	------	------	------	------	--------	100	99	88	82	33	25	38	19	A-6(12)	CL
------	------	------	------	------	--------	--------	--------	96	93	40	29	40	19	A-6(12)	CL
------	------	------	------	------	--------	100	97	52	47	23	18	26	11	A-6(4)	CL
------	------	------	------	------	100	99	96	59	55	34	26	31	16	A-6(7)	CL
------	------	------	100	99	97	95	90	56	49	32	22	27	13	A-6(5)	CL
------	------	------	100	99	96	92	89	21	14	4	3	21	2	A-2-4(0)	SM
------	------	------	------	------	100	99	99	70	66	59	56	55	31	A-7-6(18)	CH
------	------	------	------	------	100	99	98	64	59	51	48	50	27	A-7-6(14)	CL-CH
------	100	99	99	98	96	95	94	39	35	27	24	35	21	A-6(4)	SC

[2] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 10): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHTO Designation M-145-49.

[3] Based on the Unified soil classification system.

Factors of Soil Formation

The five major factors of soil formation are the climate under which the soil material accumulated and weathered; the living organisms on and in the soil; the composition of the parent material; the topography, or lay of the land; and the length of time the forces of soil formation have acted on the soil material. The relative importance of each factor differs from place to place, and each modifies the effect of the other four. In some [illegible] factor may dominate in formation

tinental winters. Precipitation is well distributed throughout the year, and peak rainfall occurs late in spring and early in fall. Evaporation is high, and rainfall seldom wets the soil below the root zone. Rainfall is sufficient to leach some of the lime from the upper horizons of soils such as Altoga and Lewisville, but not enough to leach it entirely from the soil. Consequently, many of the soils have a layer in which lime has accumulated. Other soils, such as Crockett and Mabank soils, have been leached and fine clay parti-

minerals at lower depths. When the grasses died, large amounts of these minerals were left near the surface. Lime, or other minerals, and organic matter were distributed through the soil profile as these plants died and decomposed and were replaced by new plants. When the roots of plants decomposed, they left channels that increased the intake of water and the aeration of the soil. Earthworms and other soil organisms feed on the decomposed roots. The borings of earthworms also

factors of soil formation are equal, the degree of profile formation depends mainly upon the average amount of moisture in the soil. Steep soils absorb less moisture and most have less distinct profiles than gently sloping or nearly level soils. Some steep soils have so much runoff that geologic erosion almost keeps pace with the weathering of rocks and the formation of soils. Conversely, more nearly level soils absorb more water that falls and are less likely to erode. Depressions or

environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification and then through

mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium,

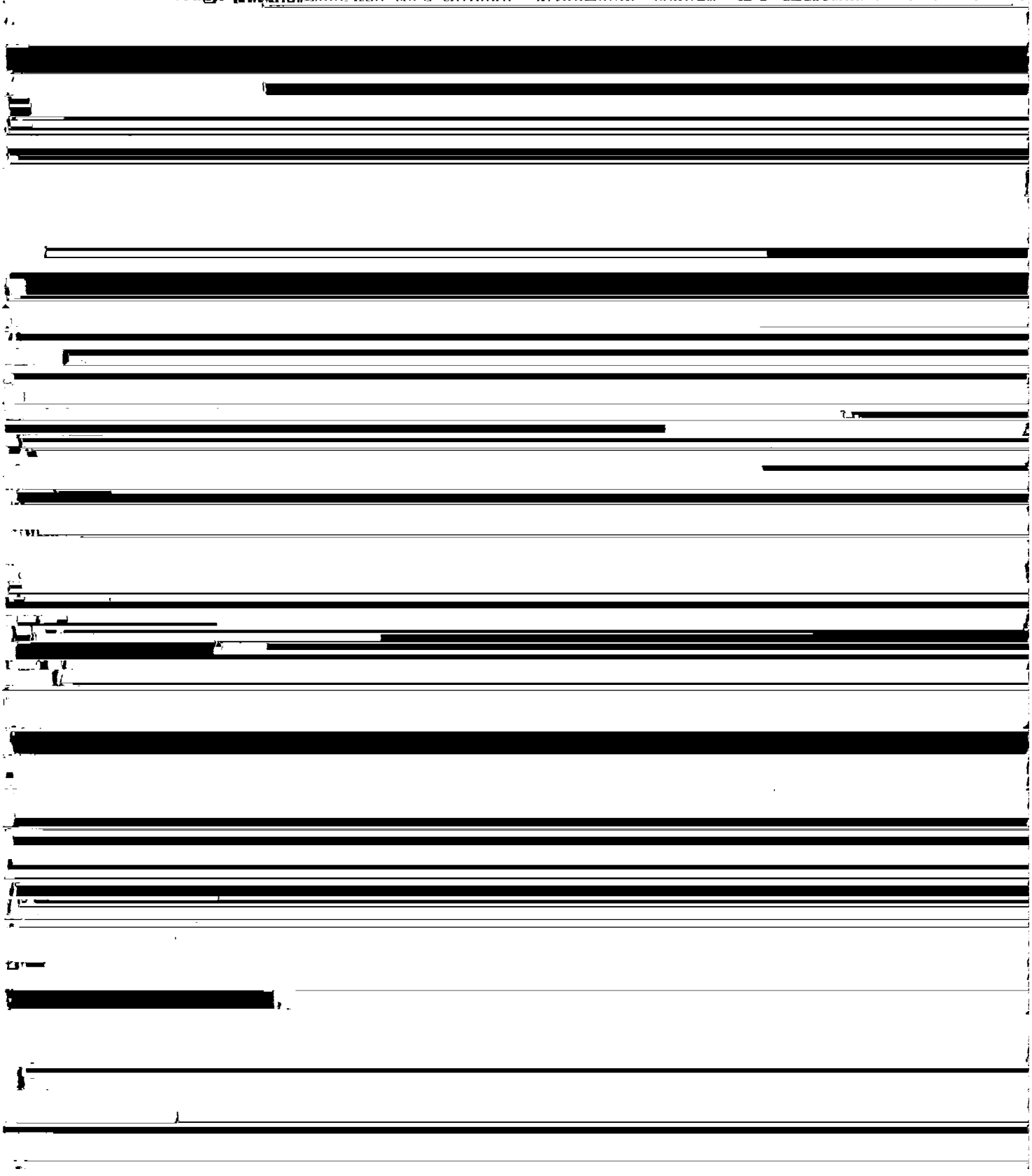


TABLE 12.—*Soil series classified by higher categories*

Series	Family	Subgroup	Order
Altoga	Fine-silty, carbonatic, thermic	Typic Ustochrepts	Inceptisols.
Arenosa	Thermic, coated	Typic Quartzipsamments	Entisols.
Austin	Fine-silty, carbonatic, thermic	Typic Haplustolls (Calciustolls)	Mollisols.
Barbarosa	Fine, montmorillonitic, thermic	Udertic Paleustolls	Mollisols.
Bosque	Fine-loamy, mixed, thermic	Cumulic Haplustolls	Mollisols.
Branyon	Fine, montmorillonitic, thermic	Udic Pellusterts	Vertisols.
Burleson	Fine, montmorillonitic, thermic	Udic Pellusterts	Vertisols.
Crockett	Fine, montmorillonitic, thermic	Udertic Paleustalfs	Alfisols.
Darst	Fine, mixed, thermic	Ultic Paleustalfs	Alfisols.
Demona	Clayey, mixed, thermic	Aquic Arenic Paleustalfs	Alfisols.
Doss	Loamy, carbonatic, thermic, shallow	Typic Calciustolls	Mollisols.

noon, with clear to partly cloudy skies a high percentage of the time during the afternoon.

Spring is a very pleasant season. March is a dry month. Warm and cool spells of short duration follow each other in rapid succession. Thundershowers increase in April and peak in May. Considerable early morning cloudiness continues but clouds dissipate earlier than in winter.

Summer temperatures are hot in the daytime. Daily maxima reach or exceed 90° F almost every day. Heavy thundershowers continue into June, but July and August are hot and dry with little variation in the weather regime from day to day. Refrigerated air-conditioning is recommended for maximum comfort indoors or in an automobile.

Fall is warm through September and precipitation increases during that month. The fall weather has greater variety than the summer weather. Daytime temperatures in October and November are pleasantly mild while nights are crisp and cool. This is the most delightful season of the year with long periods of uninterrupted fair weather and light winds.

Physiography and Drainage

Guadalupe County is in the west Gulf Coastal Plain of Texas. The county is divided into two northeastward-trending belts which are marked by soil, plant, and topographic characteristics.

The blackland prairie belt is in the northwestern third of the county. Most soils are gently sloping to sloping and were influenced by the weathering of mainly clayey, dark material.

The post oak belt occupies most of the rest of the county. In this belt, the surface slopes southeastward, and soils are sandier and timbered.

Altitude in the county ranges from about 900 feet a few miles north of Schertz to about 300 feet in the Guadalupe River channel where the river leaves the county.

Most of the county is in the drainage basin of the Guadalupe River, but the western fourth of the county is in the San Antonio River Basin. Cibolo Creek, a tributary of the San Antonio River, drains an area adjacent to Bexar and Wilson Counties. The Guadalupe

associated limestones, Austin Chalk formation, Wilcox group, Carrizo Sand formation, Leona formation, and alluvium. The Wilcox group and the Carrizo Sand formation together constitute the most favorable aquifer for large-scale ground water development. The location of the water-bearing units can be determined from the General Soil Map in this soil survey. The Wilcox group underlies the Crockett-Demona-Windthorst association, Carrizo Sand underlies the Patilo-Arenosa association, Austin Chalk formation underlies the Austin-Eddy association, and alluvium and the Leona formation underlie the Seguin-Sunev and Branyon-Barbarosa-Lewisville associations. The Edwards Limestone formation and associated limestones are mainly in the northwest part of the county.

Yields of water wells range from a few gallons per minute to as much as 2,000 gallons per minute. The largest yields are from wells in the Wilcox group. Potentially larger yields generally can be expected from properly constructed wells tapping both the Carrizo Sand formation and the Wilcox group.

The chemical quality of the water from the several

Compressible. The soil is relatively soft and decreases excessively in volume when a load is applied.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or

alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		pH
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8

soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Thin layer. Suitable soil material is not thick enough for use as borrow material or topsoil.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Type, soil. A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

Unstable fill. Banks of fill are likely to cave in or slough.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Well-graded soil. A soil or soil material consisting of particles that are well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read both the description of the mapping unit and that of the soil series to which it belongs. When referring to a capability unit or range site, read the introduction to its section for general information about its management.

Map	Capability unit	Range site	Gardening and landscaping group

Map symbol	Mapping unit	Page	Capability unit		Range site		Gardening and landscaping group
			Symbol	Page	Name		Number
QgC	Quihi soils, 1 to 5 percent slopes	28	IVs-2	40	Chalky Ridge		5
Se	Seguin silty clay loam	29	I-1	35	Loamy Bottomland		2
SuA	Sunev loam, 0 to 1 percent slopes	31	IIs-1	37	Clay Loam		2
SuB	Sunev loam, 1 to 3 percent slopes	31	IIe-2	36	Clay Loam		2
SuC3	Sunev loam, 3 to 5 percent slopes, eroded	31	IIIe-2	37	Clay Loam		2
Tr	Trinity clay	31	IIw-1	36	Clayey Bottomland		4
Tw	Trinity clay, frequently flooded	32	Vw-1	40	Clayey Bottomland		4
Uh	Uhland fine sandy loam, occasionally flooded	32	IIw-2	36	Loamy Bottomland		3
Uw	Uhland soils, frequently flooded	32	Vw-1	40	Loamy Bottomland		3
VrC	Vernia very gravelly loamy sand, 1 to 5 percent slopes	33	IVs-1	39	Very Gravelly		1

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